Appendix B
NPSM Data

This section contains information concerning BASINS ***Nonpoint Source Model*** data.

Section B.1 contains an HSPF data dictionary that can be used as an aid in populating an ***NPSM*** default data set. The HSPF data dictionary is a list of all HSPF input parameters and their corresponding definitions, units, default values, and minimum and maximum acceptable values.

Section B.2 contains information concerning the BASINS Watershed Data Management (WDM) files, which contain meteorological time series data for ***NPSM***. The section presents procedures for developing WDM files, as well as a record of procedures followed to develop the WDM files packaged with the BASINS system.

B.1 HSPF Data Dictionary

The following data dictionary has been adapted from *Hydrological Simulation Program—FORTRAN User's Manual for Release 11.0 (*Bicknell, et al., 1996). The data table presents input parameter names, definitions, units, default values, and minimum and maximum acceptable values. The table is divided into three major parts, corresponding to the three HSPF application modules:

- PERLND simulation of a pervious land segment (Table B.1.1)
- IMPLND simulation of an impervious land segment (Table B.1.2)
- RCHRES simulation of a river/reservoir reach (Table B.1.3)

Each module is made up of model sections (corresponding with specific HSPF functions), each section containing multiple input data tables. The data table names correspond with both HSPF data tables and the NPSM data editor hierarchy.

Table B.1.1 PERLND (Pervious Land Segment)

Symbol/Data Group	Definition	Default Value/Units	Minimum Value	Maximum Value
	ATEMP (Correct Air Temperature for Elevation Difference)			
ATEMP-DAT				
ELDAT	elevation difference between temperature gage and pervious land segment (PLS)	0.0 ft 0.0 m	none none	none none
AIRTMP	Initial air temperature above PLS	60 F 15 C	-60 -50	140 60
	SNOW (Simulate Accumulation and Melting of Snow and Ice)			
SNOW - PARM1				
LAT	latitude (+ in northern hemisphere, - in southern)	40	-90	90
MELEV	mean elevation	0.0 ft 0.0 m	0.0 0.0	30000.0 10000.0
SHADE	fraction of PLS covered by shade (vegetation)	0.0	0.0	1.0
SNOWCF	correction factor to account for poor catch efficiency of the gage	none	1.0	100.0
COVIND	maximum pack (water equivalent) at which entire PLS will be covered with snow	none in none mm	0.01 0.25	none none
SNOW - PARM2				
RDCSN	density of cold (< 0 deg. F), new snow relative to water	0.15	0.01	1.0
TSNOW	baseline air temp. below which precipitation will be snow	32.0 F 0.0 C	30.0 -1.0	40.0 5.0
SNOEVP	adapts the snow evaporation (sublimation) equation to field conditions	0.1	0.0	1.0
CCFACT	adapts the snow condensation/convection melt equation to field conditions	1.0	0.0	2.0
MWATER	maximum liquid water content of the snow pack, in depth water per depth water equiv.	0.03	0.0	1.0
MGMELT	max. rate of snowmelt by ground heat, in depth of water eqiv per day.	0.01 in/day 0.25 mm/day	0.0 0.0	1.0 25.0
SNOW - INIT1				
Pack-snow	quantity of snow in the pack (water equiv.)	0.0 in 0.0 mm	0.0 0.0	none none
Pack-ice	quantity of ice in the pack (water equiv.)	0.0 in 0.0 mm	0.0 0.0	none none
Pack-water	quantity of liquid water in the pack	0.0 in 0.0 mm	0.0 0.0	none none
RDENPF	density of the pack, relative to water	0.2	0.01	1.0
DULL	index to the dullness of the pack surface, from which albedo is estimated	400.0	0.0	800.0
PAKTMP	mean temp. of the frozen contents of the pack	32.0 F 0.0 C	none none	32.0 0.0
PACKF	frozen contents of the pack			

Table B.1.1 (continued)

Symbol/Data Group	Definition	Default Value/Units	Minimum Value	Maximum Value
SNOW - INIT2				
COVINX	index to areal snow coverage	0.01 in 0.25 mm	0.01 0.25	none none
XLNMLT	current remaining possible increment to the ice storage in the pack. It is only relevant if ice formation is simulated	0.0 in 0.0 mm	0.0 0.0	none none
SKYCLR	fraction of sky which is assumed to be clear	1.0	0.15	1.0
	PWATER **(Simulate Water Budget for a Pervious Land Segment [PLS])**			
PWAT – PARM1				
CSNOFG	flag for simulating snow	0	0	1
RTOPFG	flag for overland flow routing method	0	0	1
UZFG	flag for upper zone inflow computation method	0	0	1
VCSFG	flag for interception storage capacity	0	0	1
VUZFG	flag for upper zone nominal storage	0	0	1
VNNFG	flag for Manning's n for overland flow plane	0	0	1
VIFWFG	flag for interflow inflow parameter	0	0	1
VIRCFG	flag for Interflow recession constant	0	0	1
VLEFG	flag for lower zone E-T parameter	0	0	1
PWAT - PARM2				
FOREST	Fraction of the PLS which is covered by forest which will continue to transpire in winter. Only use when CSNOFG = 1 (i.e. snow being simulated)	0.0	0.0	1.0
LZSN	lower zone nominal storage	none in none mm	0.01 0.25	100.0 2500.0
INFILT	index to the infiltration capacity of the soil	none in/hr none mm/hr	0.0001 0.0025	100.0 2500.0
LSUR	length of the assumed overland flow plane	none ft none m	1.0 0.3	none none
SLSUR	slope	none	0.0000001	10.0
KVARY	parameter which affects the behavior of groundwater recession flow, enabling it to be nonexponential in its decay with time	0.0 (1/in) 0.0 (1/mm)	0.0 0.0	none none
AGWRC	basic groundwater recession rate if KVARY is zero and there is no inflow to groundwater	None 1/day	0.001	0.999
PWAT - PARM3				
PETMAX	air temp. below which E-T will arbitrarily be reduced below the value obtained from the input time series (only when CSNOFG = 1)	40.0 F 4.5 C	none none	none none
PETMIN	temp. below which E-T will be zero regardless of the value in the input time series (only when CSNOFG = 1)	35.0 F 1.7 C	none none	none none

Table B.1.1 (continued)

Symbol/Data Group	Definition	Default Value/Units	Minimum Value	Maximum Value
INFEXP	exponent in the infiltration equation	2.0	0.0	10.0
INFILD	ratio between the max and mean infiltration capacities over the PLS	2.0	1.0	2.0
DEEPFR	fraction of groundwater inflow which will enter deep (inactive) groundwater and be lost	0.0	0.0	1.0
BASETP	fraction of potential E-T which can be satisfied from baseflow (groundwater outflow)	0.0	0.0	1.0
AGWETP	fraction of remaining potential E-T which can be satisfied from active groundwater storage if enough is available	0.0	0.0	1.0
PWAT - PARM4				
CEPSC	interception storage capacity	0.0 in 0.0 mm	0.0 0.0	10.0 250.0
UZSN	upper zone nominal storage	none in none mm	0.01 0.25	10.0 250.0
NSUR	Manning's n for the assumed overland flow plane	0.1	0.001	1.0
INTFW	interflow inflow parameter	none	0.0	none
IRC	interflow recession parameter.	none 1/day	1.0E-30	0.999
LZETP	lower zone E-T parameter. It is an index to the density of deep-rooted vegetation	0.0	0.0	0.999
MON - INTERCEP				
CEPSCM(12)	monthly values of interception storage. Only required if VCSFG = 1. The values apply to the first day of the month.	0.0 in 0.0 mm	0.0 0.0	10.0 250.0
MON - UZSN				
UZSNM(12)	monthly values of upper zone nominal storage. Only required if VUZFG = 1	none in none mm	0.01 0.25	10.0 250.0
MON - MANNING				
NSURM(12)	monthly values of Manning's constant for overland flow. Only required if VNNFG = 1	0.10	0.001	1.0
MON –INTERFLW				
INTFWM(12)	monthly values of the interflow inflow parameter. Only required if VIFWFG = 1	none	0.0	none
MON – IRC				
IRCM(12)	monthly values of the interflow recession parameter. Only required if VIRCFG = 1	none 1/day	1.0E-30	0.999
MON -LZETPARM				
LZETPM(12)	monthly values of the lower zone ET parameter. Only required if VLEFG = 1	0.0	0.0	0.999
PWAT - STATE1				
CEPS	interception storage	0.0 in 0.0 mm	0.0 0.0	100 2500
SURS	surface (overland flow) storage	0.0 in	0.0	100

Table B.1.1 (continued)

Symbol/Data Group	Definition	Default Value/Units	Minimum Value	Maximum Value
		0.0 mm	0.0	2500
UZS	flag for upper zone storage	0.001 in 0.025 mm	0.001 0.025	100 2500
IFWS	interflow storage	0.0 in 0.0 mm	0.0 0.0	100 2500
LZS	lower zone storage	0.001 in 0.025 mm	0.001 0.025	100 2500
AGWS	active groundwater storage	0.0 mm 0.0 in	0.0 0.0	100 2500
GWVS	index to groundwater slope; measure of antecedent active groundwater inflow	0.0 in 0.0 mm	0.0 0.0	100 2500
	SEDMNT **(Production and Removal of Sediment in Pervious Land)**			
SED – PARM1				
CRVFG	flag for erosion related cover	0	0	1
VSIVFG	Atmospheric deposition rate	0	0	2
SDOPFG	flag that determines the algorithm used to simulate removal of sediment from land surface	0	0	1
SED - PARM2				
SMPF	supporting management practice factor. It is used to simulate the reduction in erosion achieved by use of erosion control practices.	1.0	0.001	1.0
KRER	coefficient in the soil detachment equation	0.0	0.0	none
JRER	exponent in the soil detachment equation	none	none	none
AFFIX	fraction by which detached sediment storage decreases each day, as a result of soil compaction	0.0 (1/day)	0.0	1.0
COVER	fraction of land surface which is shielded from erosion by rainfall (not considering snow cover)	0.0	0.0	1.0
NVSI	rate at which sediment enters detached storage from the atmosphere. A negative value can be used to simulate removal	0.0 lb/ac.day 0.0 kg/ha.day	none none	none none
SED - PARM3				
KSER	coefficient in the detached sediment washoff equation	0.0	0.0	none
JSER	exponent in the detached sediment washoff equation	none	none	none
KGER	coefficient in the matrix soil scour equation (simulates gully erosion, etc.)	0.0	0.0	none
JGER	exponent in the matrix soil scour equation	none	none	none
MON - COVER				
COVERM(12)	monthly values of the COVER parameter. Only required if CRVFG = 1	0.0	0.0	1.0
MON – NVSI				

Table B.1.1 (continued)

Symbol/Data Group	Definition	Default Value/Units	Minimum Value	Maximum Value
NVSIM(12)	monthly values of the net vertical sediment input. Only required if VSIFG>0	0.0 lb/ac.day 0.0 kg/ha.day	none none	none none
SED – STOR				
DETS	initial storage of detached sediment	tons/ac 0.0 tonnes/ha	0.0 0.0	none none
	PSTEMP (Simulation of Soil Temperature)			
PSTEMP – PARM1				
SLTVFG	flag for surface temperature and gradient	0	0	1
ULTVFG	flag for upper layer temperature and gradient	0	0	1
LGTVFG	flag for lower layer and G.W. temperature and gradient	0	0	1
TSOPFG	flag for subsurface soil temperature calculation	0	0	2
PSTEMP – PARM2				
ASLT	surface layer temperature, when the air temperature is 32 degrees F. It is the intercept of the surface layer temperature regression	32.0 F 0.0 C	0.0 -18.0	100.0 38.0
BSLT	slope of the surface layer temperature regression equation	1.0 F/F 1.0 C/C	0.001 0.001	2.0 2.0
FOR TSOPFG = 0 or 2				
ULTP1	smoothing factor in upper layer temperature calculation	none	none	none
ULTP2	mean difference between upper layer soil temperature and air temperature	none F none C	none none	none none
LGTP1	smoothing factor for calculating lower layer/ groundwater soil temperature	none	none	none
LGTP2	mean departure from the upper layer soil temperature for calculating lower layer/groundwater soil temperature	none F none C	none none	none none
FOR TSOPFG = 1				
ULTP1	intercept in the upper layer soil temperature regression equation	none F none C	none none	none none
ULTP2	slope in the upper layer soil temperature regression equation	none F/F none C/C	none none	none none
LGTP1	lower layer/groundwater layer soil temperature	none F none C	none none	none none
LGTP2	not used	none	none	none
MON – ASLT				
ASLTM(12)	monthly surface layer temperature when air is 32 degrees F. Only required if SLTVFG = 1	32.0 F 0.0 C	0.0 -18.0	100.0 38.0
MON – BSLT				
BSLTM(12)	monthly slope of surface layer temperature regression equation. Only required if SLTVFG = 1	1.0 F/F 1.0 C/C	0.001 0.001	2.0 2.0

Table B.1.1 (continued)

Symbol/Data Group	Definition	Default Value/Units	Minimum Value	Maximum Value
MON - ULTP1				
ULTP1M(12)	monthly parameter for estimating upper layer temperature. Only required if ULTVFG = 1 (see ULTP1 for units)	none none	none none	none none
MON - ULTP2				
ULTP2M(12)	monthly parameter for estimating upper layer temperature. Only required if ULTVFG = 1 (see ULTP2 for units)	none none	none none	none none
MON - LGTP1				
LGTP1M(12)	monthly parameter for estimating lower layer and active groundwater layer temperature calculations. Only required if LGTVFG = 1 (see LGTP1 for units)	none none	none none	none none
MON - LGTP2				
LGTP2M(12)	monthly parameter for estimating lower layer and active groundwater layer temperature calculations. Only required if LGTVFG = 1 (see LGTP2 for units)	none none	none none	none none
PSTEMP – TEMPS				
AIRTC	air temperature	60.0 F 16.0 C	-20.0 -29.0	120.0 49.0
SLTMP	surface layer soil temperature	60.0 F 16.0 C	-20.0 -29.0	120.0 49.0
ULTMP	upper layer soil temperature	60.0 F 16.0 C	-20.0 -29.0	120.0 49.0
LGTMP	lower layer/groundwater layer soil temperature	60.0 F 16.0 C	-20.0 -29.0	120.0 49.0
		PWTGAS		
PWT - PARM1				
IDVFG	flag for interflow dissolved oxygen concentration	0	0	1
ICVFG	flag for interflow CO2 concentration	0	0	1
GDVFG	flag for groundwater dissolved oxygen concentration	0	0	1
GCVFG	flag for groundwater CO2 concentration	0	0	1
PWT - PARM2				
ELEV	elevation of the PLS above sea level (used to adjust saturation concentrations of dissolved gasses in surface outflow)	0.0 ft 0.0 m	-1000.0 -300.0	30000.0 9100.0
IDOXP	concentration of dissolved oxygen in interflow outflow	0.0 mg/l	0.0	20.0
ICO2P	concentration of dissolved CO2 in interflow outflow	0.0 mg c/l	0.0	1.0
ADOXP	concentration of dissolved oxygen in active groundwater outflow	0.0 mg/l	0.0	20.0
ACO2P	concentration of dissolved CO2 in active groundwater outflow	0.0 mg c/l	0.0	1.0
MON – IFWDOX				
IDOXPM(12)	monthly parameter for concentration of DO in interflow outflow (only required if IDVFG = 1)	0.0 mg/l	0.0	20.0

Table B.1.1 (continued)

Symbol/Data Group	Definition	Default Value/Units	Minimum Value	Maximum Value
MON - IFWCO2				
ICO2PM(12)	monthly parameter for concentration of dissolved CO2 in interflow outflow (only required if ICVFG = 1)	0.0 mg c/l	0.0	1.0
MON – GRNDDOX				
ADOXPM(12)	monthly parameter for concentration of DO in active groundwater outflow (only required if GDVFG = 1)	0.0 mg/l	0.0	20.0
MON - GRNDCO2				
ACO2PM(12)	monthly parameter for concentration of dissolved CO2 in active groundwater outflow (only required if GCVFG = 1)	0.0 mg c/l	0.0	1.0
PWT – TEMPS				
SOTMP	initial surface outflow temperature	60.0 F 16.0 C	32.0 0.0	100.0 38.0
IOTMP	initial interflow outflow temperature	60.0 F 16.0 C	32.0 0.0	100.0 38.0
AOTMP	initial active groundwater outflow temperature	60.0 F 16.0 C	32.0 0.0	100.0 38.0
PWT – GASES				
SODOX	DO concentration in surface outflow	0.0 mg/l	0.0	20.0
SOCO2	CO2 concentration in surface outflow	0.0 mg c/l	0.0	1.0
IODOX	DO concentration in interflow outflow	0.0 mg/l	0.0	20.0
IOCO2	CO2 concentration in interflow outflow	0.0 mg c/l	0.0	1.0
AODOX	DO concentration in active groundwater outflow	0.0 mg/l	0.0	20.0
AOCO2	CO2 concentration in active groundwater outflow	0.0 mg c/l	0.0	1.0
	PQUAL			
QUAL – PROPS				
QSDFG	sediment associated constituent flag	0	0	1
VPFWFG	flag for washoff potency factor	0	0	2
VPFSFG	flag for scour potency factor	0	0	1
QSOFG	overland flow associated constituent flag	0	0	1
VQOFG	flag for accumulation and limiting storage factor	0	0	1
QIFWFG	interflow associated constituent flag	0	0	1
VIQCFG	flag for interflow outflow concentration	0	0	4
QAGWFG	groundwater associated constituent flag	0	0	1
VAQCFG	flag for groundwater outflow concentration	0	0	4
QUAL – INPUT				
SQO	initial storage of (sediment associated constituent) QUALOF on the surface of the PLS	0.0 qty/ac 0.0 qty/ha	0.0 0.0	none none
POTFW	washoff potency factor	0.0 qty/ton 0.0 qty/tonne	0.0 0.0	none none

Table B.1.1 (continued)

Symbol/Data Group	Definition	Default Value/Units	Minimum Value	Maximum Value
POTFS	scour potency factor	0.0 qty/ton 0.0 qty/tonne	0.0 0.0	none none
ACQOP	rate of accumulation of QUALOF	0.0 qty/ac.day 0.0 qty/ha.day	0.0 0.0	none none
SQOLIM	maximum storage of QUALOF	0.000001 qty/ac 0.000002 qty/ha	0.000001 0.000002	none none
WSQOP	rate of surface runoff which will remove 90 percent of stored QUALOF per hour	1.64 in/hr 41.7 mm/hr	0.01 0.25	none none
IOQC	concentration of the constituent in interflow outflow (only if QIFWFG = 1)	0.0 qty/ft^3 0.0 qty/l	0.0 0.0	none none
AOQC	concentration of the constituent in active (only if QAGWFG = 1) groundwater outflow	0.0 qty/ft^3 0.0 qty/l	0.0 0.0	none none
MON – POTFW				
POTFWM(12)	monthly parameter for washoff potency factor. Only required if VPFWFG > 0	0.0 qty/ton 0.0 qty/tonne	0.0 0.0	none none
MON – POTFS				
POTFSM(12)	monthly parameter for scour potency factor. Only required if VPFSFG = 1	0.0 qty/ton 0.0 qty/tonne	0.0 0.0	none none
MON – ACCUM				
ACQOPM(12)	montly parameter for rate of accumulation of QUALOF. Only required if VQOFG = 1	0.0 qty/ac.day 0.0 qty/ha.day	0.0 0.0	none none
MON – SQOLIM				
SQOLIM(12)	monthly parameter for maximum storage of QUALOF. Only required if VQOFG = 1	1. 0 E-6 qty/ac 2.0 E-6 qty/ha	1.0 E-6 2.0 E-6	none none
MON - IFLW – CONC				
IOQCM(12)	monthly parameter for concentration of QUAL in interflow. Only required if VIQCFG > 0	0.0 qty/ft^3 0.0 qty/l	0.0 0.0	none none
MON - GRND – CONC				
AOQCM(12)	monthly parameter for concentration of QUAL in groundwater. Only required if VAQCFG > 0	0.0 qty/ft^3 0.0 qty/l	0.0 0.0	none none
		MSTLAY		
UZSN – LZSN				
UZSN	nominal upper zone storage	none in none mm	0.01 0.25	10.0 250.0
LZSN	nominal lower zone storage	none in none mm	0.01 0.25	100.0 2500.0
SURS	initial surface detention storage	0.001 in 0.025 mm	0.001 0.025	100.0 2500.0
MST – PARM				
SLMPF	factor to adjust solute percolation rates from the surface layer storage to the upper layer principal storage.	1.0	0.001	1.0

Table B.1.1 (continued)

Symbol/Data Group	Definition	Default Value/Units	Minimum Value	Maximum Value
ULPF	factor to adjust solute percolation rates from the upper layer principal storage to the lower layer storage.	1.0	1.0	10.0
LLPF	factor to adjust solute percolation rates from the lower layer storage to the active and inactive groundwater.	1.0	1.0	10.0
MST – TOPSTOR				
SMSTM	initial moisture content in the surface storage	0.0 lb/ac 0.0 kg/ha	0.0 0.0	none none
UMSTM	initial moisture content in the upper principal storage	0.0 lb/ac 0.0 kg/ha	0.0 0.0	none none
IMSTM	initial moisture content in the upper transitory (interflow) storage	0.0 lb/ac 0.0 kg/ha	0.0 0.0	none none
MST – TOPFLX				
FSO	initial value of the fractional fluxes of soluble chemicals through the topsoil layers of a PLS	0.0 1/interval	0.0	1.0
FSP	initial value of the fractional fluxes of soluble chemicals through the topsoil layers of a PLS	0.0 1/interval	0.0	1.0
FII	initial value of the fractional fluxes of soluble chemicals through the topsoil layers of a PLS	0.0 1/interval	0.0	1.0
FUP	initial value of the fractional fluxes of soluble chemicals through the topsoil layers of a PLS	0.0 1/interval	0.0	1.0
FIO	initial value of the fractional fluxes of soluble chemicals through the topsoil layers of a PLS	0.0 1/interval	0.0	1.0
MST – SUBSTOR				
LMSTM	initial moisture storage in the lower layer	0.0 lb/ac 0.0 kg/ha	0.0 0.0	none none
AMSTM	initial moisture storage in the active groundwater layer	0.0 lb/ac 0.0 kg/ha	0.0 0.0	none none
MST – SUBFLX				
FLP	initial fractional flux of soluble chemicals through the subsoil	0.0 1/interval	0.0	1.0
FLDP	initial fractional flux of soluble chemicals through the subsoil	0.0 1/interval	0.0	1.0
FAO	initial fractional flux of soluble chemicals through the subsoil	0.0 1/interval	0.0	1.0
	PEST			
PEST – FLAGS				
<ITMXPS(*)>	maximum number of iterations used in solving Freundich adsorption isotherm	30	1	100
SOIL – DATA				
<depths>	thicknesses of the surface, upper, lower, and groundwater layers	none in none mm	0.001 0.0025	1000 2500

Table B.1.1 (continued)

Symbol/Data Group	Definition	Default Value/Units	Minimum Value	Maximum Value
<bulkdens>	bulk densities of the surface, upper, lower, and groundwater layers	103 lb/ft^3 1.65 gm/cc	50 0.80	150 2.40
PEST – ID				
<PESTID(*)>	names of pesticides being simulated	none	none	none
PEST – THETA				
THDSPS	adjusts the desorption rate parameter to reflect temperature dependence (by modified Arrhenius equation)	1.05	1.00	2.00
THADPS	adjusts the adsorption rate parameter to reflect temperature dependence (by modified Arrhenius equation)	1.05	1.00	2.00
PEST – FIRSTPM				
KDSPS	desorption rate at 35 deg C	0.0 (1/day)	0.0	none
KADPS	adsorption rate at 35 deg C	0.0 (1/day)	0.0	none
PEST – CMAX				
CMAX	maximum solubility of the pesticide in water	0.0 ppm	0.0	none
PEST – SVALPM				
XFIX	maximum concentration (on the soil) of pesticide which is permanently fixed to the soil	0.0 ppm	0.0	none
K1	coefficient parameter for the Freundlich adsorption/ desorption equation.	0.0 (1/kg)	0.0	none
N1	exponent for the Freundlich adsorption/desorption equation	none	1.0	none
PEST – NONSVPM				
XFIX	maximum concentration (on the soil) of pesticide which is permanently fixed in the soil. Only used if ADOPFG = 3 (non-single value Freundlich Method)	0.0 ppm	0.0	none
K1	coefficient parameter for the adsorption Freundlich curve	0.0 (1/kg)	0.0	none
N1	exponent parameter for the adsorption Freundlich curve	none	1.0	none
N2	exponent for the auxiliary (desorption) curve	none	1.0	none
PEST – DEGRAD				
SDGCON	degradation rate of the pesticide in the surface layer	0.0 (1/day)	0.0	1.0
UDGCON	degradation rate of the pesticide in the upper layer	0.0 (1/day)	0.0	1.0
LDGCON	degradation rate of the pesticide in the lower layer	0.0 (1/day)	0.0	1.0
ADGCON	degradation rate of the pesticide in groundwater	0.0 (1/day)	0.0	1.0
PEST - STOR1 <for surface, upper lower, and groundwater layers, separately>				
PSCY	initial storage of pesticide in crystalline form	0.0 lb/ac 0.0 kg/ha	0.0 0.0	none none

Table B.1.1 (continued)

Symbol/Data Group	Definition	Default Value/Units	Minimum Value	Maximum Value
PSAD	initial storage of pesticide in adsorbed form	0.0 lb/ac 0.0 kg/ha	0.0 0.0	none none
PSSU	initial storage of pesticide in solution	0.0 lb/ac 0.0 kg/ha	0.0 0.0	none none
PEST - STOR2				
IPS	Initial storage of pesticide in the upper layer transitory (interflow) storage. Only dissolved pesticide is used here	0.0 lb/ac 0.0 kg/ha	0.0 0.0	none none
	NITR			
NIT – FLAGS				
VNUTFG	flag for plant uptake parameters	0	0	1
FORAFG	flag for ammonium adsorption/desorption option	0	0	1
ITMAXA	plant nitrogen uptake reaction rate parameter for lower layer	30	1	100
BNUMN	number of timesteps between biochemical recalculation	none	1	1000
CNUMN	number of timesteps between adsorption recalculation	none	1	1000
NIT – UPTAKE				
SKPLN	plant nitrogen uptake reaction rate parameter for surface layer	0.0 (1/day)	0.0	none
UKPLN	plant nitrogen uptake reaction rate parameter for upper layer	0.0 (1/day)	0.0	none
LKPLN	plant nitrogen uptake reaction rate parameter for lower layer	0.0 (1/day)	0.0	none
AKPLN	plant nitrogen uptake reaction rate parameter for active groundwater layer	0.0 (1/day)	0.0	none
MON – NITUPT <for surface, upper, lower, and groundwater layers, separately>				
KPLNM(*)	monthly parameter for plant nitrogen uptake reaction rate	0.0 (1/day)	0.0	none
NIT – FSTGEN				
NO3UTF	fraction of nitrogen uptake which comes from nitrate	1.0	0.001	1.0
NH4UTF	fraction of nitrogen uptake which comes from ammonium	0.0	0.0	1.0
<temperature correction coefficients for the following reactions>				
THPLN	plant uptake	1.07	1.0	2.0
THKDSA	Ammonium desorption	1.05	1.0	2.0
THKADA	Ammonia adsorption	1.05	1.0	2.0
THKIMN	nitrate immobilization	1.07	1.0	2.0
THKAM	organic N ammonification	1.07	1.0	2.0
THKDNI	NO3 denitrification	1.07	1.0	2.0

Table B.1.1 (continued)

Symbol/Data Group	Definition	Default Value/Units	Minimum Value	Maximum Value
THKNI	Nitrification	1.05	1.0	2.0
THKIMA	Ammonium immobilization	1.07	1.0	2.0
NIT – FSTPM <first-order reaction rate parameters for the following reactions				
KDSAM	Ammonium desorption	0.0 (1/day)	0.0	none
KADAM	Ammonium adsorption	0.0 (1/day)	0.0	none
KIMNI	Nitrate immobilization	0.0 (1/day)	0.0	none
KAM	Organic N ammonification	0.0 (1/day)	0.0	none
KDNI	Denitrification of NO3	0.0 (1/day)	0.0	none
KNI	Nitrification	0.0 (1/day)	0.0	none
KIMAM	Ammonium immobilization	0.0 (1/day)	0.0	none
NIT – CMAX				
CMAX	Maximum solubility of ammonium in water	0.0 ppm	0.0	none
NIT – SVALPM				
XFIX	Information in this data group is analogous to PEST-SVALPM (used only if FORAFG = 1)			
K1				
N1				
NIT - STOR1 <for surface, upper, lower, and groundwater layers, separately>				
ORGN	Initial storage of organic N	0.0 lb/ac 0.0 kg/ha	0.0 0.0	none none
AMAD	Initial storage of adsorbed ammonium	0.0 lb/ac 0.0 kg/ha	0.0 0.0	none none
AMSU	Initial storage of solution ammonium	0.0 lb/ac 0.0 kg/ha	0.0 0.0	none none
NO3	Initial storage of nitrate	0.0 lb/ac 0.0 kg/ha	0.0 0.0	none none
PLTN	Initial N stored in plants, derived from this layer	0.0 lb/ac 0.0 kg/ha	0.0 0.0	none none
NIT - STOR2				
IAMSU	Initial quantity of ammonium in upper layer transitory storage	0.0 lb/ac 0.0 kg/ha	0.0 0.0	none none
INO3	Initial quantity of nitrate in upper layer transitory storage	0.0 lb/ac 0.0 kg/ha	0.0 0.0	none none
	PHOS			
PHOS-FLAGS				
VPUTFG	flag for plant uptake parameters	0	0	1
FORPFG	flag for phosporus adsorption/desorption option	0	0	1
ITMAXP	maximum number of iterations for Freudlich method	30	1	100

Table B.1.1 (continued)

Symbol/Data Group	Definition	Default Value/Units	Minimum Value	Maximum Value
BNUMP	number of timesteps between biochemical recalculation	none	1	1000
CNUMP	number of timesteps between adsorption recalculation	none	1	1000
PHOS-UPTAKE				
SKPLP	This data set is analogous to *NIT-UPTAKE*			
UKPLP				
LKPLP				
AKPLP				
MON – PHOSUPT				
KPLPM(*)	This data set is analogous to MON-NITUPT			
PHOS-FSTGEN <temperature correction coefficients for the following reactions>				
THPLP	plant uptake	1.07	1.0	2.0
THKDSP	phosphate desorption	1.05	1.0	2.0
THKADP	phosphate adsorption	1.05	1.0	2.0
THKIMP	phosphate immobilization	1.07	1.0	2.0
THKMP	organic P mineralization	1.07	1.0	2.0
PHOS-FSTPM				
KDSP	phosphate desorption	0.0 (1/day)	0.0	none
KADP	phosphate adsorption	0.0 (1/day)	0.0	none
KIMP	phosphate immobilization	0.0 (1/day)	0.0	none
KMP	organic P mineralization	0.0 (1/day)	0.0	none
PHOS-CMAX				
CMAX	maximum solubility of phosphate	0.0 ppm	0.0	none
PHOS – SVALPM				
XFIX	this data set is identical to NIT-SVALPM. It is only used if FORPFG = 1			
K1				
N1				
PHOS - STOR1 <for surface, upper, lower, and groundwater layers, separately>				
ORGP	initial storage of organic P	0.0 lb/ac 0.0 kg/ha	0.0 0.0	none none
P4AD	initial storage of adsorbed phosphate	0.0 lb/ac 0.0 kg/ha	0.0 0.0	none none
P4SU	initial storage of phosphate in solution	0.0 lb/ac 0.0 kg/ha	0.0 0.0	none none
PLTP	initial P stored in plants, derived from this layer	0.0 lb/ac 0.0 kg/ha	0.0 0.0	none none

Table B.1.1 (continued)

Symbol/Data Group	Definition	Default Value/Units	Minimum Value	Maximum Value
PHOS - STOR2				
IP4SU	initial storage of phosphate in upper layer transitory (interflow) storage	0.0 lb/ac 0.0 kg/ha	0.0 0.0	none none
	TRACER			
TRAC – ID				
TRACID(*)	name of tracer substance	none	none	none
TRAC-TOPSTOR				
STRSU	initial quantity of tracer (conservative) in surface storage	0.0 lb/ac 0.0 kg/ha	0.0 0.0	none none
UTRSU	initial quantity of tracer in upper principal storage	0.0 lb/ac 0.0 kg/ha	0.0 0.0	none none
ITRSU	initial quantity of tracer in upper transitory (interflow) storage	0.0 lb/ac 0.0 kg/ha	0.0 0.0	none none
TRAC – SUBSTOR				
LTRSU	initial storage of tracer in lower layer	0.0 lb/ac 0.0 kg/ha	0.0 0.0	none none
ATRSU	initial storage of tracer in active groundwater layer	0.0 lb/ac 0.0 kg/ha	0.0 0.0	none none

Table B.1.2 IMPLND (Impervious Land Segment)

Symbol/Data Group	Definition	Default Value/Units	Minimum Value	Maximum Value
	ATEMP			
IMPLND ATEMP	This section is analogous to ATEMP in the PERLND group			
	SNOW			
IMPLND SNOW	This section is analogous to ATEMP in the PERLND group			
	IWATER			
IWAT-PARM1				
CSNOFG	flag to consider effects of snow accumulation and melt	0	0	1
RTOPFG	flag for overland flow routing method	0	0	1
VRSFG	flag for retention storage capacity	0	0	1
VNNFG	flag for Manning's n for the overland flow plane	0	0	1
RTLIFG				
IWAT-PARM2				
LSUR	length of the assumed overland flow plane	none ft none m	1.0 0.3	none none
SLSUR	slope of the assumed overland flow plane	none	0.000001	10.0
NSUR	Manning's n for the overland flow plane	0.1	0.001	1.0
RETSC	retention (interception) storage capacity of the surface	0.0 in 0.0 mm	0.0 0.0	10.0 250.0
IWAT - PARM3				
PETMAX	air temp. below which ET will arbitrarily be reduced below the value obtained from the input time series. Only use if CSNOFG = 1	40.0 F 4.5 C	none none	none none
PETMIN	temp. below which ET will be zero regardless of the value in the input time series.	35.0 F 1.7 C	none none	none none
MON - RETN				
RETSCM(12)	monthly retention storage capacity values. Only use if VRSFG = 1	0.0 in 0.0 mm	0.0 0.0	10.0 250.0
MON – MANNING				
NSURM(12)	monthly values for Manning's n values. Only required if VNNFG = 1	0.10	0.001	1.0
IWAT - STATE1				
RETS	retention storage	0.001 in 0.025 mm	0.001 0.025	100 2500
SURS	surface (overland flow) storage	0.001 in 0.025 mm	0.001 0.025	100 2500
	SOLIDS			
SLD – PARM1				
VASDFG	flag for solid accumulation rate	0	0	1
VRSDFG	flag for solid removal rate option	0	0	1
SDOPFG	flag that determines the algorithm used to simulate removal of sediment from the land surface	0	0	1

Table B.1.2 IMPLND (Impervious Land Segment)

Symbol/Data Group	Definition	Default Value/Units	Minimum Value	Maximum Value
SLD - PARM2				
KEIM	coefficient in the solids washoff equation	0.0	0.0	None
JEIM	exponent in the solids washoff equation	none	none	none
ACCSDP	rate at which solids accumulate on the land surface	0.0 tons/ac.day 0.0 tonnes/ha.day	0.0 0.0	none none
REMSDP	fraction of solids storage which is removed each day when no runoff	0.0 (1/day)	0.0	1.0
MON – SACCUM				
ACCSDM(12)	monthly solids accumulation rates. Only needed if VASDFG = 1	0.0 tons/ac.day 0.0 tonnes/ha.day	0.0 0.0	none none
MON – REMOV				
REMSDM(12)	monthly solids unit removal rate. Only needed if VRSDFG = 1	0.0 1/day	0.0	1.0
SLD – STOR				
SLDS	initial storage of solids	0.0 tons/ac 0.0 tonnes/ha	0.0 0.0	none none
		IWTGAS		
IWT – PARM1				
WTFVFG	flag to choose constant or monthly temperature regression parameters	0	0	1
CSNOFG	flag to consider effects of snow accumulation and melt	0	0	1
IWT - PARM2				
ELEV	elevation of the impervious land segment (ILS) above sea level	0.0 ft 0.0 m	-1000.0 -300.0	30000.0 9100.0
AWTF	surface water temperature, when the air temperature is 32 degrees F	32.0 F 0.0 C	0.0 -18.0	100.0 38.0
BWTF	slope of the surface water temperature regression equation	1.0 F/F 1.0 C/C	0.001 0.001	2.0 2.0
MON - AWTF				
AWTFM(12)	monthly values for AWTF. Only required if WTFVFG = 1	32.0 F 0.0 C	0.0 -18.0	100.0 38.0
MON – BTWF				
BWTFM(12)	monthly values for slope of the surface water temperature regression equation. Only required if WTFVFG = 1	1.0 F/F 1.0 C/C	0.001 0.001	2.0 2.0
IWT – INIT				
SOTMP	initial temperature of the surface runoff	60.0 F 16.0 C	32.0 0.01	100.0 38.0
SODOX	initial DO content of the surface runoff	0.0 mg/l	0.0	20.0
SOCO2	initial CO_2 content of the surface runoff	0.0 mg c/l	0.0	1.0

Table B.1.2 IMPLND (Impervious Land Segment)

Symbol/Data Group	Definition	Default Value/Units	Minimum Value	Maximum Value
	IQUAL			
QUAL – PROPS				
QSDFG	flag for sediment associated constituent	0	0	1
VPFWFG	flag for scour potency factor	0	0	1
QSOFG	flag for overland flow associated constituent	0	0	1
VQOFG	flag for accumulation and limiting storage	0	0	1
QUAL – INPUT				
SQO	initial storage of overland flow associated constituent (QUALOF) on the surface of the ILS	0.0 qty/ac 0.0 qty/ha	0.0 0.0	none none
POTFW	Washoff potency factor. Only applicable if the constituent is sediment associated constituent (QUALSD)	0.0 qty/ton 0.0 qty/tonne	0.0 0.0	none none
ACQOP	rate of accumulation of QUALOF	0.0 qty/ac.day 0.0 qty/ha.day	0.0 0.0	none none
SQOLIM	maximum storage of QUALOF	0.000001 qty/ac 0.000002 qty/ha	0.000001 0.000002	none none
WSQOP	rate of surface runoff which will remove 90% of stored QUALOF per hour	1.64 in/hr 41.7 mm/hr	0.01 0.25	none none
MON - POTFW	this data set is identical to the corresponding table in PERLND			
MON - ACCUM	this data set is identical to the corresponding table in PERLND			
MON - SQOLIM	this data set is identical to the corresponding table in PERLND			

Table B.1.3 RCHRES (River / Reservoir Reach)

Symbol/Data Group	Definition	Default Value/Units	Minimum Value	Maximum Value
	HYDR			
HYDR – PARM1				
VCONFG	flag for F[VOL] outflow demand components	0	0	1
AUX1FG	flag to calculate depth, stage, surface area, average depth, and top width	0	0	1
AUX2FG	flag to calculate average velocity and average cross-sectional area	0	0	1
AUX3FG	flag to calculate shear velocity and bed shear stress	0	0	1
ODFVFG	flag for F[VOL] component of the outflow demand	0	-5	8
ODGTFG	flag for G[T] component of the outflow demand	0	0	5
FUNCT	flag for combining outflow demand components	1	1	3
HYDR - PARM2				
FTBDSN	WDM table dataset number containing the F-Table	0	0	999
FTABNO	if FTBDSN = 0, then FTABNO is the user's number for the F-Table which contains the geometric and hydraulic properties of RCHRES. Else, it is the WDM table indicator	none	1	999
LEN	length of the RCHRES	none miles none km	0.01 0.016	none none
DELTH	drop in water elevation from the upstream to the downstream extremities of the RCHRES	0.0 ft 0.0 m	0.0 0.0	none none
STCOR	correction to the RCHRES depth to calculate stage	0.0 ft 0.0 m	none none	none none
KS	weighting factor for hydraulic routing	0.0	0.0	0.99
DB50	median diameter of the bed sediment (assumed constant throughout the run)	0.01 in 0.25 mm	0.0001 0.0025	100.0 2500.0
MON – CONVF				
CONVFM(12)	monthly F(VOL) adjustment factors	0.0	0.0	none
HYDR – INIT				
VOL	initial volume of water in RCHRES	0.0 acre-ft 0.0 Mm^3	0.0 0.0	none none
COLIND(5)	for an exit, it indicates the pair of columns used to evaluate the initial value of the F(VOL) component of outflow demand for the exit	4.0	4.0	8.0
OUTDGT(5)	specifies the G(T) component of the initial outflow demand for each exit from RCHRES	0.0 ft^3/s 0.0 m^3/s	0.0 0.0	none none
	ADCALC			
ADCALC – DATA				
CRRAT	ratio of maximum velocity to mean velocity in the RCHRES cross section under typical flow conditions	1.5	1.0	none
VOL	volume of water in the RCHRES at the start of the simulation. Not required if **HYDR** is active	0.0 acre-ft 0.0 Mm^3	0.0 0.0	none none

Table B.1.3 (continued)

Symbol/Data Group	Definition	Default Value/Units	Minimum Value	Maximum Value
	CONS			
CONS - DATA				
CONID(5)	name of the conservative constituent	none	none	none
CON	initial concentration of the constituent	0.0	0.0	none
CONCID	specifies the concentration units of the constituent	none	none	none
CONV	conversion factor from QTYID/VOL to CONCID	none	1.0E-30	none
QTYID	specifies the units which the total flow of the constituent into or out of RCHRES will be expressed	none	none	None
	HTRCH			
HEAT – PARM				
ELEV	mean RCHRES elevation	0.0 ft 0.0 m	0.0 0.0	30000.0 10000.0
ELDAT	difference in elevation between the RCHRES and the air temperature gage (positive if RCHRES is higher than the gage)	0.0 ft 0.0 m	none none	none none
CFSAEX	fraction of RCHRES surface exposed to radiation	1.0	0.001	2.0
KATRAD	longwave radiation coefficient	9.37	1.0	20.0
KCOND	conduction - convection heat transport coefficient	6.12	1.0	20.0
KEVAP	evaporation coefficient	2.24	1.0	10.0
HEAT – INIT				
TW	initial water temperature in RCHRES	60.0 F 15.5 C	32.0 0.0	200.0 95.0
AIRTMP	initial air temperature at RCHRES	60.0 F 15.5 C	-90.0 -70.0	150.0 65.0
	SEDTRN			
SANDFG				
SANDFG	flag to choose method for sand load simulation: Toffaletti, Colby, or user-specified power function	3	1	3
SED – GENPARM				
BEDWID	width of the cross-section over which HSPF will assume bed sediment is deposited regardless of stage, top-width, etc. Used to estimate bed sediment depth	none ft none m	1.0 0.3	none none
BEDWRN	bed depth, which if exceeded will create warning message	100.0 ft 30.5 m	0.001 0.0003	none none
POR	porosity of the bed (volume voids / total volume) used to estimate bed depth	0.5	0.1	0.9
SED – HYDPARM				
LEN	length of RCHRES	none mi none km	0.01 0.016	none none
DELTH	drop in water elevation	0.0 ft 0.0 m	0.0 0.0	none none

Table B.1.3 (continued)

Symbol/Data Group	Definition	Default Value/Units	Minimum Value	Maximum Value
DB50	median diameter of bed sediment	0.01 in 0.25 mm	0.0001 0.0025	100.0 2500.0
SAND - PM				
D	effective diameter of the transported sand particles	none in none mm	0.001 0.025	100.0 2500.0
W	corresponding fall velocity in still water	none in/sec none mm/sec	0.02 05	500.0 12500.0
RHO	density of the sand particles	2.65 gm/cm^3	1.0	4.0
KSAND	coefficient in the sand load power function formula	0.0	0.0	none
EXPSND	exponent in the sand load power function formula	0.0	0.0	none
SILT - CLAY - PM				
D	effective diameter of the particles	0.0 in 0.0 mm	0.0 0.0	0.003 0.07
W	fall velocity in still water	0.0 in/sec 0.0 mm/sec	0.0 0.0	0.2 5.0
RHO	density of the particles	2.65 gm/cm^3	2.0	4.0
TAUCD	critical bed shear stress for deposition. Above this stress, there will be no deposition	1.0E10 lb/ft^2 1.0E10 kg/m^2	1.0E-10 1.0E-10	none none
TAUCS	critical bed shear stress for scour. Below this value there will be no scour	1.0E10 lb/ft^2 1.0E10 kg/m^2	1.0E-10 1.0E-10	none none
M	erodibility coefficient of the sediment	0.0 lb/ft^2.d 0.0 kg/m^2.d	0.0 0.0	none none
SSED – INIT				
SSED(3)	three values are initial concentrations of suspended sand, silt, and clay, respectively	0.0 mg/l	0.0	none
BED – INIT				
BEDDEP	initial total depth (thickness) of the bed	0.0 ft 0.0 m	0.0 0.0	none none
<fracsand>	initial fraction (by weight) of sand in bed material	1.0	0.0001	1.0
<fracsilt>	initial fraction of silt	0.0	0.0	0.9999
<fracclay>	initial fraction of clay	0.0	0.0	0.9999
	GQUAL			
GQ - GENDATA				
TEMPFG	flag for source of water temperature data	2	1	3
PHFLAG	flag for source of pH data	2	1	3
ROXFG	flag for source of free radical oxygen data	2	1	3
CLDFG	flag for source of cloud cover data	2	1	3
SDFG	flag for source of total sediment concentration data	2	1	3
PHYTFG	flag for source of phytoplankton data	2	1	3
LAT	latitude of RCHRES	0 degrees	-54	54

Table B.1.3 (continued)

Symbol/Data Group	Definition	Default Value/Units	Minimum Value	Maximum Value
GQ - QALDATA				
GQID	name of constituent (qual)	none	none	none
DQAL	initial dissolved concentration of qual	0.0	0.0	none
CONCID	concentration units (implied "per liter")	none	none	none
CONV	factor to convert from qty/vol to concentration units	none	1.0E-30	none
QTYID	name of qty unit for qual	none	none	none
GQ – HYDPM				
KA	second order acid rate constant for hydrolysis	none 1/sec	1.0E-30	none
KB	second order base rate constant for hydrolysis	none 1/sec	1.0E-30	none
KN	first order rate constant of neutral reaction with water	none 1/sec	1.0E-30	none
THHYD	temperature correction coefficient for hydrolysis	1.0	1.0	2.0
GQ – ROXPM				
KOX	second order rate constant for oxidation by free radical oxygen	none 1/sec	1.0E-30	none
THOX	temperature correction coefficient for oxidation by free radical oxygen	1.0	1.0	2.0
GQ – PHOTPM				
PHOTPM(1-18)	molar absorption coefficients for qual for 18 wavelength ranges of light	0.0 (1/cm)	0.0	none
PHOTPM(19)	quantum yield for the qual in air-saturated pure water	1.0	0.0001	10.0
PHOTPM(20)	temperature correction coefficient for photolysis	1.0	1.0	2.0
GQ - CFGAS				
CFGAS	ratio of volatilization rate to oxygen reaeration rate	none	1.0E-30	none
GQ – BIOPM				
BIOCON	second order rate constant for biodegradation of qual by biomass	none 1/mg.day	1.0E-30	none
THBIO	temperature correction coefficient for biodegradation of qual	1.07	1.0	2.0
BIO	concentration of biomass causing biodegradation of qual	none mg/l	0.00001	none
MON – BIO				
BIOM(12)	monthly values of biomass	none mg/l	0.00001	none
GQ – GENDECAY				
FSTDEC	first order decay rate for qual	none 1/day	0.00001	none
THFST	temperature correction coefficient for first order decay of qual	1.07	1.0	2.0
GQ – SEDDECAY				
ADDCPM(1)	decay rate for qual adsorbed to suspended sediment	0.0 (1/day)	0.0	none

Table B.1.3 (continued)

Symbol/Data Group	Definition	Default Value/Units	Minimum Value	Maximum Value
ADDCPM(2)	temperature correction for decay of qual on suspended sediment	1.07	1.0	2.0
ADDCPM(3)	decay rate for qual adsorbed to bed sediment	0.0 (1/day)	0.0	none
ADDCPM(4)	temperature correction coefficient for decay of qual on bed sediment	1.07	1.0	2.0
GQ – KD				
ADPM(1,1)	distribution coefficient for qual with suspended sand	none 1/mg	1.0E-10	none
ADPM(2,1)	with suspended silt	none 1/mg	1.0E-10	none
ADPM(3,1)	with suspended clay	none 1/mg	1.0E-10	none
ADPM(4,1)	with bed sand	none 1/mg	1.0E-10	none
ADPM(5,1)	with bed silt	none 1/mg	1.0E-10	none
ADPM(6,1)	with bed clay	none 1/mg	1.0E-10	none
GQ – ADRATE				
ADPM(1,2)	transfer rate between adsorbed and desorbed states for qual with suspended sand	none 1/day	0.00001	none
ADPM(2,2)	with suspended silt	none 1/day	0.00001	none
ADPM(3,2)	with suspended clay	none 1/day	0.00001	none
ADPM(4,2)	with bed sand	none 1/day	0.00001	none
ADPM(5,2)	with bed silt	none 1/day	0.00001	none
ADPM(6,2)	with bed clay	none 1/day	0.00001	none
GQ – ADTHETA				
ADPM(1,3)	temperature correction coefficients for adsorption / desorption on suspended sand	1.07	1.0	2.0
ADPM(2,3)	on suspended silt	1.07	1.0	2.0
ADPM(3,3)	on suspended clay	1.07	1.0	2.0
ADPM(4,3)	on bed sand	1.07	1.0	2.0
ADPM(5,3)	on bed silt	1.07	1.0	2.0
ADPM(6,3)	on bed clay	1.07	1.0	2.0
GQ – SEDCONC				
SQAL(1)	initial concentration of qual on suspended sand	0.0 concu/mg	0.0	none
SQAL(2)	on suspended silt	0.0 concu/mg	0.0	none
SQAL(3)	on suspended clay	0.0 concu/mg	0.0	none
SQAL(4)	on bed sand	0.0 concu/mg	0.0	none
SQAL(5)	on bed silt	0.0 concu/mg	0.0	none
SQAL(6)	on bed clay	0.0 concu/mg	0.0	none
GQ – VALUES				
TWAT	water temperature (if modeled as constant, i.e., TEMPFG = 2)	60.0 F 15.5 C	32.0 0.1	212.0 100.0
PHVAL	pH (if modeled as constant i.e., PHFLAG = 2)	7.0	1.0	14.0

Table B.1.3 (continued)

Symbol/Data Group	Definition	Default Value/Units	Minimum Value	Maximum Value
ROC	free radical oxygen concentration (if modeled as constant, i.e., ROXFG = 2)	0.0 mol/l	0.0	none
CLD	cloud cover (if modeled as constant, i.e., CLDFG = 2)	0.0 tenths	0.0	10.0
SDCNC	total suspended sediment concentration (if modeled as constant, i.e., SDFG = 2)	0.0 mg/l	0.0	none
PHY	phytoplankton concentration (as biomass) (if modeled as constant, i.e., PHYTFG = 2)	0.0 mg/l	0.0	none
MON – WATEMP				
TEMPM(12)	monthly values of water temperature (if TEMPFG = 3)	60.0 F 15.5 C	32.0 0.0	212.0 100.0
MON – PHVAL				
PHVALM(12)	monthly values of pH (if PHFLAG = 3)	7.0	1.0	14.0
MON – ROXYGEN				
ROCM(12)	monthly values of free radical oxygen (if ROXFG = 3)	0.0 mol/l	0.0	none
GQ - ALPHA				
ALPH(18)	Values of base absorbance coefficient	none 1/cm	0.00001	none
GQ – GAMMA				
GAMM(18)	Values of sediment absorbance coefficient	0.0 (1/mg.cm)	0.0	none
GQ - DELTA				
DEL(18)	values of phytoplankton absorbance	0.0 (1/mg.cm)	0.0	none
GQ – CLDFACT				
KCLD(18)	light extinction efficiency of cloud cover	0.0	0.0	1.0
MON - CLOUD				
CLDM(12)	monthly values of average cloud cover	0.0 tenths	0.0	10.0
MON – SEDCONC				
SEDCNCM(12)	monthly average suspended sediment concentration	0.0 mg/l	0.0	none
MON – PHYTO				
PHYM(12)	monthly values of phytoplankton concentration	0.0 mg/l	0.0	none
GQ – DAUGHTER				
C(2,1)	indicates the amount of qual #2 which is produced by decay of qual #1 through all simulated decay processes	0.0	0.0	none
C(3,1)		0.0	0.0	none
C(3,2)		0.0	0.0	none
	RQUAL			
BENTH – FLAG				
BENRFG	flag to choose benthal influences	0	0	1

Table B.1.3 (continued)

Symbol/Data Group	Definition	Default Value/Units	Minimum Value	Maximum Value
SCOUR – PARMS				
SCRVEL	velocity above which effects of scouring on benthal release rates is considered	10.0 ft/sec 3.05 m/sec	0.01 0.01	none none
SCRMUL	multiplier to increase benthal releases during scouring	2.0	1.0	none
	OXRX			
OX - FLAGS				
REAMFG	flag to choose reaeration calculation method	2	1	3
OX - GENPARM				
KBOD20	unit BOD decay rate @ 20 degrees C	none 1/hr	1.0E-30	none
TCBOD	temperature correction coefficient for BOD decay	1.075	1.0	2.0
KODSET	rate of BOD settling	0.0 ft/hr 0.0 m/hr	0.0 0.0	none none
SUPSAT	maximum allowable dissolved oxygen supersaturation (expressed as multiple of DO saturation concentration)	1.15	1.0	2.0
ELEV				
ELEV	mean elevation of RCHRES (above seal level)	0.0 ft 0.0 m	0.0 0.0	30000.0 10000.0
OX - BENPARM				
BENOD	benthal oxygen demand at 20 degrees C (with unlimited DO concentration)	0.0 $mg/m^2.hr$	0.0	none
TCBEN	temperature correction coefficient for benthal oxygen demand	1.074	1.0	2.0
EXPOD	exponential factor in the dissolved oxygen term of the benthal oxygen demand equation	1.22	0.1	none
BRBOD(1)	benthal release of BOD at high oxygen concentration	72.0 $mg/m^2.hr$	0.0001	none
BRBOD(2)	increment to benthal release of BOD under anaerobic conditions	100.0 $mg/m^2.hr$	0.0001	none
EXPREL	exponential factor in the dissolved oxygen term of the benthal BOD release equation	2.82	0.1	none
OX - CFOREA				
CFOREA	correction factor in the lake reaeration equation, to account for good or poor circulation characteristics	1.0	0.001	10.0
OX - TSIVOGLOU				
REAKT	empirical constant in Tsivoglou's equation for reaeration (escape coefficient)	0.08 1/ft	0.001	1.0
TCGINV	temperature correction coefficient for surface gas invasion (if REAMFG = 1)	1.047	1.0	2.0
OX - LEN – DELTH				
LEN	length of RCHRES	none mi none km	0.01 0.01	none none

Table B.1.3 (continued)

Symbol/Data Group	Definition	Default Value/Units	Minimum Value	Maximum Value
DELTH	drop (energy) over its length	none ft none m	0.00001 0.00001	none none
OX – TCGINV				
TCGINV	temperature correction coefficient for surface gas invasion (if REAMFG = 2)	1.047	1.0	2.0
OX – REAPARM				
TCGINV	see above (if REAMFG = 3)	1.047	1.0	2.0
REAK	empirical constant for equation used to calculate reaeration coefficient	none 1/hr	1.0E-30	none
EXPRED	exponent to depth used in calculation of reaeration coefficient	0.0	none	0.0
EXPREV	exponent to velocity used in calculation of reaeration coefficient	0.0	0.0	none
OX – INIT				
DOX	dissolved oxygen	0.0 mg/l	0.0	20.0
BOD	biochemical oxygen demand	0.0 mg/l	0.0	none
SATDO	dissolved oxygen saturation concentration	10.0 mg/l	0.1	20.0
	NUTRX			
NUT - FLAGS				
TAMFG	flag to simulate total ammonia	0	0	1
NO2FG	flag to simulate nitrite	0	0	1
PO4FG	flag to simulate ortho-phosphorus	0	0	1
AMVFG	flag to simulate ammonia evaporization	0	0	1
DENFG	flag to simulate denitrification	0	0	1
ADNHFG	flag to simulate NH4 adsorption	0	0	1
ADPOFG	flag to simulate PO4 adsorption	0	0	1
PHFLAG	flag for source of pH data	2	1	3
CONV - VAL1				
CVBO	Conversion from milligrams biomass to milligrams oxygen	1.98 mg/mg	1.0	5.0
CVBPC	Conversion from biomass expressed as phosphorus to carbon equivalency	106.0 mol/mol	50.0	200.0
CVBPN	conversion from biomass expressed as phosphorus to nitrogen equivalency	16.0 mol/mol	10.0	50.0
BPCNTC	percentage, by weight, of biomass which is carbon	49.0	10.0	100.0
NUT – BENPARM				
BRTAM(2)	benthal release of total ammonia. (1) indicates aerobic rate and (2) indicates anaerobic rate	0.0 $mg/m^2.hr$	0.0	none
BRPO4(2)	benthal release of ortho-phosphate. Subscripts same as above	0.0 $mg/m^2.hr$	0.0	none

Table B.1.3 (continued)

Symbol/Data Group	Definition	Default Value/Units	Minimum Value	Maximum Value
ANAER	concentration of dissolved oxygen below which anaerobic conditions exist	0.005 mg/l	0.0001	1.0
NUT – NITDENIT				
KTAM20	nitrification rate of ammonia at 20 degrees C	none 1/hr	0.001	none
KNO220	nitrification rate of nitrite at 20 degrees C	none 1/hr	0.001	none
TCNIT	temperature correction coefficient for nitrification	1.07	1.0	2.0
KNO320	nitrification rate of nitrate at 20 degrees C	none 1/hr	0.001	none
TCDEN	temperature correction coefficient for denitrification	1.07	1.0	2.0
DENOXT	dissolved oxygen concentration threshold for denitrification	2.00 mg/l	0.0	none
NUT - NH3VOLAT				
EXPNVG	exponent in the gas layer mass transfer coefficient equation for NH_3 volatilization	0.5	0.1	2.0
EXPNVL	exponent in the liquid layer mass transfer coefficient equation for NH_3 volatilization	0.6667	0.1	2.0
NUT – BEDCONC				
BNH4(3)	constant bed concentrations of NH4-N adsorbed to (1) sand, (2) silt, and (3) clay	0.0 mg/kg	0.0	none
BPO4(3)	constant bed concentrations of PO4-P adsorbed to (1) sand, (2) silt, and (3) clay	0.0 mg/kg	0.0	none
NUT – ADSPARM				
ADNHPM(3)	partition coefficients for NH4-N adsorbed to (1) sand, (2) silt, and (3) clay	1.0E-10 ml/g	1.0E-10	none
ADPOPM(3)	partition coefficients for PO4-P adsorbed to (1) sand, (2) silt, and (3) clay	1.0E-10 ml/g	1.0E-10	none
NUT – DINIT				
NO3	initial concentration of nitrate (as N)	0.0 mg/l	0.0	none
TAM	initial concentration of total ammonia	0.0 mg/l	0.0	none
NO2	initial concentration of nitrite	0.0 mg/l	0.0	none
PO4	initial concentration of ortho-phosphorus (as P)	0.0 mg/l	0.0	none
PHVAL	constant (annual) (if PHFLAG = 2) or initial value (if PHFLAG = 1 or 3) of pH	7.0	0.0	14.0
NUT – ADSINIT				
SNH4(3)	initial concentrations of NH3-N adsorbed to (1) sand, (2) silt, and (3) clay	0.0 mg/kg	0.0	none
SPO4(3)	initial concentrations of PO4-P adsorbed to (1) sand, (2) silt, and (3) clay	0.0 mg/kg	0.0	none
	PLANK			
PLANK - FLAGS				
PHYFG	flag to simulate phytoplankton	0	0	1
ZOOFG	flag to simulate zooplankton	0	0	1

Table B.1.3 (continued)

Symbol/Data Group	Definition	Default Value/Units	Minimum Value	Maximum Value
BALFG	flag to simulate benthic algae	0	0	1
SDLTFG	flag to simulate influence of sediment washload on light extinction	0	0	1
AMRFG	flag to simulate ammonia retardation of nitrogen limited growth	0	0	1
DECFG	flag to simulate linkage between carbon dioxide and phtytoplankton growth	0	0	1
NSFG	flag to simulate ammonia as part of available nitrogen supply in nitrogen limited growth calculations	0	0	1
ZFOOD	flag to indicate quality of zooplankton food	2	1	3
SURF - EXPOSED				
CFSAEX	used to adjust the input solar radiation to make it applicable to RCHRES. e.g., account for shading by trees	1.0	0.001	1.0
PLNK - PARM1				
RATCLP	ratio of chlorophyll content of biomass to phosphorus content	0.6	0.01	none
NONREF	nonrefractory fraction of algae and zooplankton biomass	0.5	0.01	1.0
LITSED	multiplication factor to total sediment concentration to determine sediment contribution to light extinction	0.0 (1/mg.ft)	0.0	none
ALNPR	fraction of nitrogen requirements for phytoplankton growth satisfied by nitrate	1.0	0.01	1.0
EXTB	base extinction coefficient for light	none 1/ft none 1/m	0.001 0.001	none none
MALGR	maximal unit algal growth rate	0.3 1/hr	0.001	none
PLNK - PARM2				
CMMLT	Michaelis-Menten constant for light limited growth	0.033 ly/min	1.0E-6	none
CMMN	nitrate Michaelis-Menten constant for nitrogen limited growth	0.045 mg/l	1.0E-6	none
CMMNP	nitrate Michaelis-Menten constant for phosphorus limited growth	0.0284 mg/l	1.0E-6	none
CMMP	phosphate Michaelis-Menten constant for phosphorus limited growth	0.0150 mg/l	1.0E-6	none
TALGRH	temperature above which algal growth ceases	95.0 F 35.0 C	50.0 10.0	212.0 100.0
TALGRL	temperature below which algal growth ceases	43.0 F 6.1 C	32.0 0.0	212.0 100.0
TALGRM	temperature below which algal growth is retarded	77.0 F 25.0 C	32.0 0.0	212.0 100.0
PLNK - PARM3				

Table B.1.3 (continued)

Symbol/Data Group	Definition	Default Value/Units	Minimum Value	Maximum Value
ALR20	algal unit respiration rate at 20 degrees C	0.004 1/hr	1.0E-6	none
ALDH	high algal unit death rate	0.01 1/hr	1.0E-6	none
ALDL	low algal unit death rate	0.001 1/hr	1.0E-6	none
OXALD	increment to phytoplankton unit death rate due to anaerobic conditions	0.03 1/hr	1.0E-6	none
NALDH	inorganic nitrogen concentration below which high algal death rate occurs (as nitrogen)	0.0 mg/l	0.0	none
PALDH	inorganic phosphorus concentration below which high algal death rate occurs (as phosphorus)	0.0 mg/l	0.0	none
PHYTO – PARM				
SEED	concentration of plankton not subject to advection under high flow conditions	0.0 mg/l	0.0	none
MXSTAY	concentration of plankton not subject to advection at very low flow conditions	0.0 mg/l	0.0	none
OREF	outflow at which concentration of plankton not subject to advection is midway between SEED and MXSTAY	0.0001 ft^3/s 0.0001 m^3/s	0.0001 0.0001	none none
CLALDH	chlorophyll A concentration above which high algal death rate occurs	50.0	0.01	none
PHYSET	rate of phytoplankton settling	0.0 ft/hr 0.0 m/hr	0.0 0.0	none none
REFSET	rate of settling for dead refractory organics	0.0 ft/hr 0.0 m/hr	0.0 0.0	none none
ZOO - PARM1				
MZOEAT	maximum zooplankton unit ingestion rate	0.055 mg phyto/mg zoo.hr	0.001	none
ZFIL20	zooplankton filtering rate at 20 degrees C	none 1/mg zoo.hr	0.001	none
ZRES20	zooplankton unit respiration rate at 20 degrees C	0.0015 1/hr	1.0E-6	none
ZD	natural zooplankton unit death rate	0.0001 1/hr	1.0E-6	none
OXZD	increment to unit zooplankton death rate due to anaerobic conditions	0.03 1/hr	1.0E-6	none
ZOO - PARM2				
TCZFIL	temperature correction coefficient for filtering	1.17	1.0	2.0
TCZRES	temperature correction coefficient for respiration	1.07	1.0	2.0
ZEXDEL	fraction of nonrefractory zooplankton excretion which is immediately decomposed when ingestion rate > MZOEAT	0.7	0.001	1.0
ZOMASS	average weight of a zooplankton organism	0.0003 mg/org	1.0E-6	1.0
BENAL – PARM				
MBAL	maximum benthic algae density (as biomass)	600.0 mg/m^2	0.01	none
CFBALR	ratio of benthic algal to phytoplankton respiration	1.0	0.01	1.0
CFBALG	ratio of benthic algal to phytoplankton growth rate	1.0	0.01	1.0

Table B.1.3 (continued)

Symbol/Data Group	Definition	Default Value/Units	Minimum Value	Maximum Value
PLNK – INIT				
PHYTO	phytoplankton concentration, as biomass	0.96E-6 mg/l	1.0E-10	none
ZOO	zooplankton concentration	0.03 org/l	1.0E-6	none
BENAL	benthic algae concentration, as biomass	1.0E-8 mg/m^2	1.0E-10	none
ORN	dead refractory organic nitrogen concentration	0.0 mg/l	0.0	none
ORP	dead refractory organic phosphorus concentration	0.0 mg/l	0.0	none
ORC	dead refractory organic carbon concentration	0.0 mg/l	0.0	none
	PHCARB			
PH – PARM1				
PHCNT	maximum number of iterations used to solve for pH	25	1	100
ALKCON	number of the conservative substance used to simulate alkalinity	1	1	10
PH - PARM2				
CFCINV	ratio of carbon dioxide invasion rate to oxygen reaeration rate	0.913	0.001	1.0
BRCO2(1)	benthal release of CO_2 (as carbon) for aerobic conditions	62.0 mg/m^2.hr	0.01	none
BRCO2(2)	benthal release of CO_2 for anaerobic conditions	62.0 mg/m^2.hr	0.01	none
PH - INIT				
TIC	initial total inorganic carbon	0.0 mg/l	0.0	none
CO2	initial carbon dioxide (as carbon)	0.0 mg/l	0.0	none
PH	initial pH	7.0	1.0	15.0

B.2 Weather Data Files (WDM)

Nonpoint source modeling using BASINS requires the development of a Watershed Data Management (WDM) file. The WDM file is a binary file containing time series data for all meteorological parameters required by Hydrological Simulation Program - FORTRAN (HSPF) algorithms. Section B.2.1 provides a summary of the general procedure required to develop WDM files. Section B.2.2 provides a description of the specific procedures followed during the development of the WDM files provided with BASINS Version 2.0.

B.2.1 Developing WDM Files

1. Obtain meteorological data for the desired period. (See Section B.2.2 for meteorological data sources used in the BASINS 2.0 WDM files.) BASINS requires data collected at hourly intervals for nonpoint source modeling, although daily data can be converted to hourly data through the use of METCMP (computer program for meteorological data generation - HSPF). If all meteorological parameters are not available, METCMP can be used to calculate a number of parameters, including potential evapotranspiration, evaporation, and solar radiation. BASINS currently supports the use of standard U.S. units. The required input data and units are as follows:

Data Description	U.S. units
Measured air temperature	deg. F
Measured precipitation	in/hr
Measured dewpoint temperature	deg. F
Measured wind movement	mph
Measured solar radiation	Ly/hr
Cloud cover (range: 0-10)	tenths
Potential evapotranspiration	in/hr
Potential surface evaporation	in/hr

2. Convert the meteorological data into a format recognized by HSPF and its utility programs (a sequential time series format is desirable). Data processing can be performed using a number of methods. Due to the enormous size of meteorological data files, the development of FORTRAN programs to extract and convert these data is recommended. Each meteorological parameter should be contained in a unique file. The required sequential time series file formats for meteorological data collected at hourly and daily intervals, as listed in the *Hydrologic Simulation Program-FORTRAN User's Manual,* are as follows:

   Hourly data:

   1. Alphanumeric state PO code (this field is not read)
   2. Station number or identifier (this field is not read)
   3. Year
   4. Month
   5. Card no:
      1 is for a.m. hours
      2 is for p.m. hours
   6. Twelve fields for hourly data

   The default format is: (A2, 1X, I4, 1X, I4, 1X, I2, 1X, I1, 12F5.2)

Daily data:

1. Alphanumeric state PO code (this field is not read)

2. Station number or identifier (this field is not read)

3. Last 2 digits of the calendar year

4. Month

5. Card no:
   1 is for days 1-10
   2 is for days 2-20
   3 is for days 21-

6. Ten fields, for the daily data (eleven fields for card number 3)

The default format is: (A2, I4, 1X, I2, A2, A1, 11F6.1)

Due to the nature of the HSPF model, every parameter but measured precipitation must have a value for each record during the entire time period of the file. For measured precipitation, a value must be present for every hour of each day precipitation was recorded. If data are missing, appropriate values must be assigned.

3. Create a WDM file using ANNIE (computer program for interactive hydrologic data management - see http://h2o.usgs.gov/software/annie.html) and declare the data sets into which time series data will be imported. HSPF requires a unique data set for each meteorological parameter to be imported. BASINS allocates 20 data set fields relating to specific meteorological parameters for each WDM station. Using ANNIE, data sets in WDM files are designated by a unique number and other pertinent information relating to the time series data field in which the data are imported. The following list displays data sets and a brief description of the information contained in each data set, for a template WDM file used to import both hourly and daily data sets for 10 WDM stations.

Data set Fields	Data set	Data set Numbers	Description Parameter
1	PREC	(11,31,51,...191)	hourly precipitation
2	EVAP	(12,32,52,...192)	hourly evaporation
3	ATEM	(13,33,53,...193)	hourly temperature
4	WIND	(14,34,54,...194)	hourly windspeed
5	SOLR	(15,35,55,...195)	hourly solar radiation
6	PEVT	(16,36,56,...196)	hourly potential evapotranspiration
7	DEWP	(17,37,57,...197)	hourly dewpoint temperature
8	CLOU	(18,38,58,...198)	hourly cloud cover
9	TMAX	(19,39,59,...199)	daily maximum temperature
10	TMIN	(20,40,60,...200)	daily minimum temperature
11	DWND	(21,41,61,...201)	daily windspeed
12	DCLO	(22,42,62,...202)	daily cloud cover
13	DPTP	(23,43,63,...203)	daily dewpoint temperature
14	DSOL	(24,44,64,...204)	daily solar radiation
15	DEVT	(25,45,65,...205)	daily evapotranspiration
16	DEVP	(26,46,66,...206)	daily evaporation
17	—	(27,47,67,...207)	empty
18	—	(28,48,68,...208)	empty
19	—	(29,49,69,...209)	empty
20	—	(30,50,70,...210)	empty

Data sets are numbered from 11 to 210. Note that all hourly information is listed in data fields 1 to 8. These hourly values are used by HSPF algorithms. The remaining data fields (9 to 16) contain daily time series data, as well as intermediate time series data used in the conversion of HSPF parameters.

4. Create the .inf file. The .inf file is used to relate information in the WDM file to the BASINS Nonpoint Source Model (NPSM). Each WDM file is required to have an .inf file with exactly the same name (only the extensions are different: .wdm versus .inf). The information required for the .inf file includes the number of stations in the WDM file, various station information (state, name, ID #, elevation, period of record, and the evaporation coefficient), and the data set numbers for each of the meteorological parameters for each station. Refer to .inf files packaged with BASINS for the standard format. Each state WDM file with BASINS has a corresponding .inf file located in the BASINS\DATA\MET_DATA directory.

5. Create .uci files. These files are used to import meteorological data into the WDM file. They are essentially HSPF input files which perform the import function. Refer to the *Hydrologic Simulation Program-FORTRAN User's Manual* for development of an input file for importing data into a WDM file.

6. Import meteorological data from each file (which are currently in a sequential time series format) into the corresponding WDM file data sets. This is done by running HSPF for each .uci file as follows:

   - Hourly precipitation data is imported into data sets denoted by PREC

- Hourly evaporation data are imported into data sets denoted by EVAP
- Hourly temperature data are imported into data sets denoted by ATEM
- Hourly windspeed data are imported into data sets denoted by WIND
- Hourly solar radiation data are imported into data sets denoted by SOLR
- Hourly potential evapotranspiration data are imported into data sets denoted by PEVT
- Hourly dewpoint temperature data are imported into data sets denoted by DEWP
- Hourly cloud cover data are imported into data sets denoted by CLOU
- Daily maximum temperature data are imported into data sets denoted by TMAX
- Daily minimum temperature data are imported into data sets denoted by TMIN
- Daily total wind movement data are imported into data sets denoted by DWND
- Daily cloud cover data are imported into data sets denoted by DCLO
- Daily dewpoint temperature data are imported into data sets denoted by DPTP
- Daily solar radiation data are imported into data sets denoted by DSOL
- Daily potential evapotranspiration data are imported into data sets denoted by DEVT
- Daily evaporation data are imported into data sets denoted by DEVP

7. If all meteorological data are not in an hourly format, develop additional time series data required by HSPF. This is done using METCMP (computer program for meteorological data generation - HSPF). METCMP enables a user to disaggregate daily time series data into hourly time series data for certain meteorological parameters, as well as calculate additional meteorological time series data required by HSPF algorithms.

B.2.2 BASINS WDM Files

WDM files, providing meteorological coverage for the United States and U.S. territories were prepared for BASINS 2.0 through the following steps:

1. Data were obtained from the following sources.

   a. Hourly observed precipitation data for the United States and U.S. territories were obtained from the National Climatic Data Center (NCDC) Hourly and Fifteen Minute Precipitation database, compiled by EarthInfo, Inc. This four CD-ROM data set contains precipitation data from NCDC's TD-3240 file. Included in the database are over 6000 weather stations with recorded precipitation for the general period of 1948-1995.

   b. Hourly surface observation data for the United States and U.S. territories were obtained from NCDC's Solar and Meteorological Surface Observational Network (SAMSON) and Hourly U.S. Weather Observations 1990-1995 (HUSWO) databases. SAMSON is a three CD-ROM data set containing both observational and modeled hourly solar radiation data, as well as hourly cloud cover, drybulb temperature, dewpoint temperature, and wind movement data from 237 NWS stations for the period of 1961-1990. The HUSWO data set, contained on a single CD-ROM, updates meteorological data from the SAMSON data set, excluding solar radiation data for the period of 1990-1995.

   c. The remaining parameters—potential evapotranspiration, evaporation, and solar radiation (for the period of 1991-1995)—were calculated using METCMP.

2. A coverage of WDM weather stations for BASINS 2.0 was created in ArcView using latitude and longitude coordinates from selected weather stations included in NCDC's Hourly and Fifteen Minute Precipitation database. These stations, which included the precipitation data, were then assigned meteorological data from the set of NWS stations available from the SAMSON data set. The selection of weather stations used to create the WDM station coverage, as well as the assignment of meteorological data to these stations, was performed in ArcView using an array of GIS coverages. This was done to provide a spatially distributed coverage of the United States and U.S. territories, based on information relating to annual rainfall, climatic divisions in the conterminous United States, completeness of weather station data, elevation, physical divisions in the conterminous United States, and proximity to NWS stations. A complete list of the ArcView coverages used in the selection of WDM weather stations is detailed in B.2.2.a. The resulting ArcView coverage consisted of 477 WDM weather stations for the United States and U.S. territories. This coverage was then divided by EPA regions. EPA regional coverage included WDM weather stations that closely bordered the region or were contained within HUCs intersecting the region. A complete list of the WDM stations is included in B.2.2.b.

3. The data were extracted and converted into a sequential time series format.

   a. Hourly precipitation data were extracted from the EarthInfo, Inc., NCDC Hourly and Fifteen Minute Precipitation database by exporting data for individual stations into ASCII tabular formatted files. These raw data were then preprocessed through a FORTRAN program for conversion to a sequential file format.

Missing precipitation data were assigned appropriate values. A value of 0.0 was normally used where no reading was available.

Preprocessing also included the identification and editing of rainfall accumulation values within the file. Rainfall accumulation values occurred where hourly precipitation values for a time period were not recorded.

The following assumptions and corresponding actions refer to rainfall accumulation data.

- If an accumulation value was recorded for an accumulation period of ≤ 24 hours, then the accumulation value was divided by the number of hours in the period.

  - If the resulting hourly value was ≥ 0.01 in. and < 2.0 in., then each hour in the accumulation period was given the resulting hourly value. The state code, station identifier, accumulation period end date and hour, accumulation value, number of hours in the accumulation period, resulting hourly value, and “Value Distributed” were listed in a text file (BASINS\DATA\MET-DATA\<ST>.TXT).

  - If the resulting hourly value was < 0.01 in., then each hour in the accumulation period was given a value of 0.0 in. The accumulation value (which in all situations will be ≤ 0.24 in.) was left unchanged, i.e. the original recorded accumulation value was used. The state code, station identifier, accumulation period end date and hour, accumulation value, number of hours in the accumulation period, resulting hourly value of 0.0 in., and “Calculated Value < .01, Accumulated Value Reported” were listed in a text file (BASINS\DATA\MET-DATA\<ST>.TXT).

  - If the resulting hourly value was ≥ 2.0 in., then each hour in the accumulation period was given a value of 0.0 in. The accumulation value is additionally deleted from the record. This prevented the existence of a large spike precipitation value in the data (which in all situations was ≥ 4.0 in. for the accumulation period). The state code and station identifier number, the accumulation period end date and hour, accumulation value, number of hours in the accumulation period, and “Calculated Value > 2.0, Accumulated Value Deleted” were listed in a text file (BASINS\DATA\MET-DATA\<ST>.TXT).

- If an accumulation value was recorded for an accumulation period of > 24 hours, then the accumulation value was not distributed evenly over the accumulation period.

  - If the accumulation value was < 2.0 in., then the value was not changed. The state code and station identifier number, the accumulation period end date and hour, accumulation value, number of hours in the accumulation period, and “Accumulation Interval > 24 hrs and Observed Value < 2 Accumulated Value Reported” were listed in a text file (BASINS\DATA\MET-DATA\<ST>.TXT).

  - If the accumulation value was ≥ 2.0 in., then the value was deleted from the record. The state code and station identifier number, the accumulation period end date and hour, accumulation value, number of hours in the accumulation period, and “Accumulation Interval > 24 hrs and Observed Value > 2 Accumulated Value Deleted” were listed in a text file (BASINS\DATA\MET-DATA\<ST>.TXT).

b. Hourly meteorological data were extracted from NOAA's Solar and Meteorological Surface Observational Network (SAMSON) database by exporting the yearly data files for an individual station from a CD ROM and unzipping them into an ASCII text file. These raw data were then preprocessed through a FORTRAN program to organize the data into a sequential time series format, convert the data into U.S. units, and calculate daily variables required by METCMP for the estimation of Solar Radiation (for the years 1991-95), Pan Evaporation, and Potential Evapotranspiration.

Hourly data files included:

- ATEM average hourly air temperature
- WIND average hourly wind speed
- SOLR total hourly solar radiation
- DEWP average hourly dew point temperature
- CLOU average hourly cloud cover

Daily data files included:

- TMAX maximum daily air temperature
- TMIN minimum daily air temperature
- DWND total daily wind movement
- DSOL total daily solar radiation
- DPTP average daily dew point temperature
- DCLO average daily cloud cover

Due to the nature of the data, missing data was assigned the previously recorded value.

Data conversions included:

- ATEM and DEWP from °C to °F
- WIND from m/s to mph
- SOLR from Wh/m^2 to Langleys ($calories/cm^2$)

Data calculations included:

- TMAX from ATEM
- TMIN from ATEM
- DCLO from CLOU
- DPTP from DEWP
- DSOL from SOLR
- DWND from WIND

4. WDM, .inf, and .uci iles were created using the templates described in B.2.1 steps 4 and 5 and then imported the data into WDM files as described in B.2.1 step 6.

5. Once time series data for precipitation and other meteorological data were imported into WDM file data sets, additional meteorological time series data were created. This was done using METCMP (computer program for meteorological data generation - HSPF). METCMP enables a user to

calculate additional meteorological time series data required by HSPF algorithms, as well as disaggregate daily time series data into hourly time series data for certain meteorological parameters.

- Daily solar radiation for the period 1991-1995 was computed in METCMP using daily cloud cover (DCLO) as an input. The daily solar radiation time series was placed in the DSOL data set. The METCMP disaggregate function then was used to distribute daily solar radiation into hourly values. Hourly solar radiation values were placed in the SOLR data set.

- Daily pan evaporation was computed using the Penman Method in METCMP. Required inputs were: daily maximum (TMAX) and daily minimum (TMIN) temperatures, daily dewpoint temperature (DPTP), daily wind movement (DWND), and daily solar radiation (DSOL). Daily evapotransporation was placed in the DEVP data set. Daily evaporation was distributed into hourly values using the disaggregate function. Hourly evaporation values were placed in the EVAP data set.

- Daily potential evapotranspiration was computed using the Hamon Method in METCMP. Required inputs were: daily maximum (TMAX) and daily minimum (TMIN) temperatures. Daily evapotranspiration was placed in the DEVT data set. Daily potential evapotranspiration was distributed into hourly values using the disaggregate function. Hourly potential evapotranspiration values were placed in the PEVT data set.

B.2.2.a Coverages used in BASINS WDM File Development

- A coverage of cooperative network stations from NCDC's Hourly and Fifteen Minute Precipitation database data set created using latitude and longitude coordinates. The information in this coverage includes:

Station ID#	a cooperative network index number between 1-9999.
State	the state's 2 digit postal code.
Station name	NCDC's assigned station name.
Begin date	first month, day, and year of the period of record.
End date	last month, day, and year of the period of record.
Elevation	meters above sea level (this was converted to feet).
Latitude	in degrees and minutes (always North) (this was converted to decimal degrees).
Longitude	in degrees and minutes (always west) (this was converted to decimal degrees).
Recorded years	the number of years with recorded data (there may be gaps).
Percent coverage	percent of the days between begin and end dates that have reported data.
Precipitation data	a column denoting the database containing the hourly precipitation data.
Relate column	an empty column reserved for the ID# of the NOAA weather station containing meteorological data that will be assigned to the station.

- A coverage of National Weather Service stations from NOAA's Solar and Meteorological Surface Observation Network (SAMSON) data set created using latitude and longitude coordinates. The information included in this coverage included:

Station ID#	the stations Weather Bureau Army Navy number.
State	the state's 2 digit postal code.
Station name	NCDC's assigned station name.
Timezone	lagged by universal time.
Elevation	meters above sea level (this was converted to feet).
Latitude	in degrees and minutes (always North) (this was converted to decimal degrees).
Longitude	in degrees and minutes (always west) (this was converted to decimal degrees).
Evap data	a column denoting the database containing the hourly evaporation data.
Temp data	a column denoting the database containing the hourly temperature data.
Wind data	a column denoting the database containing the hourly windspeed data.
Solar data	a column denoting the database containing the hourly solar radiation data.
Pevt data	a column denoting the database containing the hourly potential evapotranspiration data.
Dew pt data	a column denoting the database containing the hourly dew point temperature data.
Cloud data	a column denoting the database containing the hourly cloud cover data.

- A coverage of the U.S. state boundaries provided by ESRI on-line ArcData (www.esri.com).

- A coverage of annual precipitation for North America provided by ESRI on-line ArcData (www.esri.com). This data set was intended as a thematic data layer representing average annual precipitation, in millimeters per year, for North America.

- A coverage of Climate Divisions provided by the National Climatic Data Center (NCDC). This coverage was used to display seasonal maps of precipitation and temperature for the conterminous United States.

- A coverage of Hydrologic Unit Boundaries and Codes provided by the National Climatic Data Center (NCDC). This data set was used to display drainage basins for the conterminous United States.

- A coverage of Physiographic Divisions in the conterminous United States provided by the National Climatic Data Center (NCDC). It was automated from Fennemans 1:7,000,000-scale map, "Physical Divisions of the United States," which is based on eight major divisions, 25 provinces, and 86 sections representing distinctive areas having common topography, rock types and structure, and geologic and geomorphic history.

- A coverage of average annual runoff in the conterminous United States, 1951-1980 provided by the National Climatic Data Center (NCDC). This coverage is intended as a thematic data layer representing average annual runoff, in inches per year, for the conterminous United States. Appropriate maps of the data can show the geographical distribution of runoff in tributary streams for the years 1951-80 and can describe the magnitudes and variations of runoff nationwide. The data was prepared to reflect the runoff of tributary streams rather than in major rivers in order to represent more accurately the local or small scale variation in runoff with precipitation and other geographical characteristics.

B.2.2.b BASINS WDM Files Weather Station List

State	Sta_#	Sta_Name	COOP_ID	Lat_dd	long_dd
AK	1	ANCHORAGE WSCMO AP	280	61.1667	-150.017
AK	2	ANNETTE WSO AIRPORT	352	55.0333	-131.567
AK	3	COLD BAY WSO AIRPORT	2102	55.2	-162.717
AK	4	FAIRBANKS WSO AIRPOR	2968	64.8167	-147.867
AK	5	KING SALMON WSO AP	4766	58.6833	-156.65
AK	6	MCGRATH WSO AIRPORT	5769	62.9667	-155.617
AK	7	ST PAUL ISLAND WSO A	8118	57.15	-170.217
AK	8	YAKUTAT WSO AIRPORT	9941	59.5167	-139.667
AL	1	ABBEVILLE 1 NNW	8	31.5833	-85.2833
AL	2	BIRMINGHAM FAA ARPT	831	33.5667	-86.7
AL	3	DADEVILLE 2	2124	32.8333	-85.75
AL	4	HALEYVILLE	3620	34.2333	-87.6333
AL	5	HUNTSVILLE WSO AP	4064	34.65	-86.7833
AL	6	JACKSONVILLE	4209	33.8167	-85.7667
AL	7	MOBILE WSO ARPT	5478	30.6833	-88.25
AL	8	MONTGOMERY WSO ARPT	5550	32.3	-86.4
AL	9	THOMASVILLE	8178	31.9167	-87.7333
AL	10	TUSCALOOSA OLIVER DA	8385	33.2167	-87.6
AR	1	ALUM FORK	130	34.8	-92.85
AR	2	BATESVILLE LIVESTOCK	458	35.8333	-91.7667
AR	3	BULL SHOALS DAM	1020	36.3667	-92.5667
AR	4	CLARKSVILLE 6 NE	1457	35.5333	-93.4
AR	5	EUREKA SPRINGS 3 WNW	2356	36.4167	-93.7833
AR	6	FORT SMITH WSO AIRPO	2574	35.3333	-94.3667
AR	7	MENA	4756	34.5667	-94.2667
AR	8	MILLWOOD DAM	4839	33.6833	-93.9833
AR	9	MONTICELLO 3 SW	4900	33.6	-91.8
AR	10	STUTTGART 9 ESE	6920	34.4667	-91.4167
AZ	1	AJO	80	32.3667	-112.867
AZ	2	COCHISE 4 SSE	1870	32.0667	-109.9
AZ	3	FLAGSTAFF AP	3010	35.1333	-111.667
AZ	4	KEAMS CANYON	4586	35.8167	-110.2
AZ	5	PAYSON	6323	34.2333	-111.333
AZ	6	PHOENIX AIRPORT	6481	33.4333	-111.983
AZ	7	TUCSON WSO AP	8820	32.1333	-110.933
AZ	8	TUWEEP	8895	36.2833	-113.067

State	Sta_#	Sta_Name	COOP_ID	Lat_dd	long_dd
AZ	9	WHITERIVER 1 SW	9271	33.8167	-109.983
AZ	10	YUMA WSO AP	9660	32.6667	-114.6
CA	1	BAKERSFIELD AP	442	35.4333	-119.05
CA	2	BLUE CANYON	897	39.2833	-120.7
CA	3	EUREKA WFO WOODLEY I	2910	40.8	-124.167
CA	4	FRESNO AIR TERMINAL	3257	36.7833	-119.717
CA	5	LOS ANGELES WSO ARPT	5114	33.9333	-118.4
CA	6	SACRAMENTO FAA ARPT	7630	38.5167	-121.5
CA	7	SAN DIEGO WSO AIRPOR	7740	32.7333	-117.167
CA	8	SAN FRANCISCO WSO AP	7769	37.6167	-122.383
CA	9	SANTA MARIA WSO ARPT	7946	34.9	-120.45
CA	10	YOSEMITE PARK HDQTRS	9855	37.75	-119.583
CO	1	AKRON 4 E	109	40.15	-103.15
CO	2	ALAMOSA WSO AP	130	37.45	-105.867
CO	3	BOULDER 2	843	40.0333	-105.283
CO	4	COLORADO SPRINGS WSO	1778	38.8167	-104.717
CO	5	GRAND JUNCTION WSO A	3488	39.1	-108.5
CO	6	KIM 15 NNE	4538	37.45	-103.317
CO	7	NUNN	6023	40.7	-104.783
CO	8	PUEBLO WSO AP	6740	38.2833	-104.5
CO	9	SUGARLOAF RESERVOIR	8064	39.25	-106.367
CO	10	TELLURIDE 4 WNW	8204	37.95	-107.867
CT	1	BRIDGEPORT SIKORSKY	806	41.1667	-73.1333
CT	2	HARTFORD BRADLEY AP	3456	41.9333	-72.6833
CT	3	JEWETT CITY	3857	41.6333	-71.9
CT	4	THOMASTON DAM	8330	41.7	-73.05
DE	1	GEORGETOWN 5 SW	3570	38.6333	-75.45
DE	2	WILMINGTN NEW CASTLE	9595	39.6667	-75.6
FL	1	DAYTONA BEACH REG AP	2158	29.1833	-81.05
FL	2	JACKSONVILLE INTL AP	4358	30.4833	-81.7
FL	3	KEY WEST INTL ARPT	4570	24.55	-81.75
FL	4	MIAMI INTL ARPT	5663	25.8	-80.3
FL	5	NICEVILLE	6240	30.5167	-86.5
FL	6	ORTONA LOCK 2	6657	26.7833	-81.3
FL	7	RAIFORD STATE PRISON	7440	30.0667	-82.1833
FL	8	TALLAHASSEE MUNI AP	8758	30.3833	-84.3667
FL	9	TAMPA INTL ARPT	8788	27.9667	-82.5333
FL	10	W PALM BEACH INTL AP	9525	26.6833	-80.1167

State	Sta_#	Sta_Name	COOP_ID	Lat_dd	long_dd
GA	1	ATHENS MUNI AP	435	33.95	-83.3167
GA	2	ATLANTA HARTSFIELD	451	33.65	-84.4333
GA	3	AUGUSTA BUSH FIELD	495	33.3667	-81.9667
GA	4	CALHOUN EXP STATION	1474	34.4833	-84.9667
GA	5	COLUMBUS METRO AP	2166	32.5167	-84.95
GA	6	DAHLONEGA 3 NNW	2479	34.5833	-84
GA	7	EDISON	3028	31.5667	-84.7333
GA	8	JESUP	4671	31.6167	-81.8833
GA	9	MACON LEWIS B WILSON	5443	32.7	-83.65
GA	10	SAVANNAH INTL AP	7847	32.1333	-81.2
HI	1	HILO WSO AP 87	1492	19.7167	-155.067
HI	2	HONOLULU WSFO AP 703	1919	21.3333	-157.917
HI	3	KAHULUI WSO AP 398	2572	20.9	-156.433
HI	4	KANALOHULUHULU 1075	3099	22.1333	-159.667
HI	5	KEAIWA CAMP 22.1	3925	19.2333	-155.483
HI	6	KUALAPUU 534	4778	21.15	-157.033
HI	7	LALAMILO FLD OF 191.	5260	20.0167	-155.683
HI	8	LIHUE WSO AP 1020.1	5580	21.9833	-159.35
HI	9	PAAKEA 350	7194	20.8167	-156.117
HI	10	PUNALUU PUMP 905.2	8314	21.5833	-157.9
IA	1	CENTERVILLE	1354	40.7333	-92.8667
IA	2	DES MOINES AP	2203	41.5333	-93.6667
IA	3	IRWIN 3 ESE	4174	41.7833	-95.15
IA	4	LARRABEE	4644	42.8667	-95.55
IA	5	LENOX	4746	40.8833	-94.5667
IA	6	MCGREGOR	5315	43.0167	-91.1833
IA	7	MOUNT PLEASANT 1 SSW	5796	40.95	-91.5667
IA	8	ST ANSGAR	7326	43.3833	-92.9167
IA	9	SIOUX CITY AP	7708	42.4	-96.3833
IA	10	WATERLOO WSO AP	8706	42.55	-92.4
ID	1	BOISE WSFO AIRPORT	1022	43.5667	-116.217
ID	2	CALDER	1370	47.2667	-116.183
ID	3	CASCADE 1 NW	1514	44.5333	-116.05
ID	4	FENN RANGER STATION	3143	46.1167	-115.567
ID	5	GOODING 1 S	3677	42.9167	-114.7
ID	6	GRASMERE 3 S	3811	42.3333	-115.883
ID	7	LEADORE	5169	44.6833	-113.367
ID	8	POCATELLO WSO AP	7211	42.9167	-112.6

State	Sta_#	Sta_Name	COOP_ID	Lat_dd	long_dd
ID	9	SANDPOINT EXP STATIO	8137	48.2833	-116.567
ID	10	TETONIA EXPERIMENT S	9065	43.85	-111.267
IL	1	AUGUSTA	330	40.2333	-90.95
IL	2	BELLEVILLE SIU RESEA	510	38.5167	-89.85
IL	3	CHICAGO MIDWAY AP 3	1577	41.7333	-87.7833
IL	4	MOLINE WSO AP	5751	41.4333	-90.5
IL	5	MURPHYSBORO 2 SW	5983	37.7667	-89.3667
IL	6	NEWTON 6 SSE	6159	38.9167	-88.1167
IL	7	PEORIA WSO AIRPORT	6711	40.6667	-89.6833
IL	8	PIPER CITY	6819	40.7	-88.1833
IL	9	ROCKFORD WSO AP	7382	42.2	-89.1
IL	10	SPRINGFIELD WSO AP	8179	39.85	-89.6833
IN	1	EVANSVILLE WSO AP	2738	38.05	-87.5333
IN	2	FORT WAYNE WSO AP	3037	41	-85.2
IN	3	INDIANAPOLIS WSFO AP	4259	39.7333	-86.2667
IN	4	PERU WASTE WATER PLA	6864	40.75	-86.0667
IN	5	RICHMOND WTR WKS	7370	39.8833	-84.8833
IN	6	SHOALS HIWAY 50 BRID	8036	38.6667	-86.8
IN	7	SOUTH BEND WSO AP	8187	41.75	-86.1667
IN	8	VALPARAISO WATERWORK	8999	41.5167	-87.0333
IN	9	VERSAILLES WATERWORK	9069	39.0667	-85.25
IN	10	WEST LAFAYETTE 6 NW	9430	40.4667	-87
KS	1	BIG BOW 4 WSW	802	37.55	-101.633
KS	2	COLLYER 10 S	1730	38.9	-100.117
KS	3	COLUMBUS 1 SW	1740	37.1667	-94.85
KS	4	CONCORDIA WSO ARPT	1767	39.55	-97.65
KS	5	DODGE CITY WFO AP	2164	37.7667	-99.9667
KS	6	FALL RIVER LAKE	2686	37.65	-96.0833
KS	7	GOODLAND WFO	3153	39.3667	-101.7
KS	8	PHILLIPSBURG 1 SSE	6374	39.7333	-99.3167
KS	9	TOPEKA WSFO AIRPORT	8167	39.0667	-95.6333
KS	10	WICHITA WSO ARPT	8830	37.65	-97.4333
KY	1	BUCKHORN LAKE	1080	37.35	-83.3833
KY	2	CLINTON 4 S	1631	36.6167	-88.9667
KY	3	COVINGTON WSO AIRPOR	1855	39.05	-84.6667
KY	4	HODGENVILLE-LINCOLN	3929	37.5333	-85.7333
KY	5	LEXINGTON WSO AIRPOR	4746	38.0333	-84.6
KY	6	LOUISA 2 S	4946	38.1167	-82.6

State	Sta_#	Sta_Name	COOP_ID	Lat_dd	long_dd
KY	7	LOUISVILLE WSFO AP	4954	38.1833	-85.7333
KY	8	PADUCAH WALKER BOAT	6117	37.05	-88.55
KY	9	SOMERSET 2 NE	7508	37.1167	-84.6
KY	10	WOODBURY	8824	37.1833	-86.6333
LA	1	ALEXANDRIA	98	31.3167	-92.4667
LA	2	BATON ROUGE WSO AP	549	30.5333	-91.1333
LA	3	CALHOUN RESEARCH STN	1411	32.5167	-92.3333
LA	4	LAFAYETTE	5021	30.2167	-92.0667
LA	5	LAKE CHARLES AP	5078	30.1333	-93.2167
LA	6	MORGAN CITY	6394	29.6833	-91.1833
LA	7	NATCHITOCHES	6582	31.7667	-93.1
LA	8	NEW ORLEANS WSCMO AR	6660	29.9833	-90.25
LA	9	SHREVEPORT AP	8440	32.45	-93.8167
LA	10	WINNSBORO 5 SSE	9806	32.1	-91.7167
MA	1	BIRCH HILL DAM	666	42.6333	-72.1167
MA	2	BOSTON LOGAN INTL AP	770	42.3667	-71.0333
MA	3	BRIDGEWATER	840	41.95	-70.95
MA	4	HYANNIS	3821	41.6667	-70.3
MA	5	KNIGHTVILLE DAM	3985	42.2833	-72.8667
MA	6	NEW BEDFORD	5246	41.6333	-70.9333
MA	7	PROVINCETOWN	6681	42.05	-70.1833
MA	8	WORCESTER MUNI AP	9923	42.2667	-71.8667
MD	1	BALT-WASHGTN INTL AP	465	39.1833	-76.6667
MD	2	BELTSVILLE	700	39.0333	-76.8833
MD	3	HANCOCK	4030	39.7	-78.1833
MD	4	SAVAGE RIVER DAM	8065	39.5167	-79.1333
MD	5	UNIONVILLE	9030	39.45	-77.1833
ME	1	AUGUSTA	273	44.3	-69.7833
ME	2	CARIBOU MUNI ARPT	1175	46.8667	-68.0167
ME	3	CLAYTON LAKE	1472	46.6167	-69.5333
ME	4	EASTPORT	2426	44.9167	-67
ME	5	GRAND LAKE STREAM	3261	45.1833	-67.7833
ME	6	MILLINOCKET	5304	45.65	-68.7
ME	7	ORONO 2	6435	44.8833	-68.6667
ME	8	PORTLAND INTL JETPRT	6905	43.65	-70.3
ME	9	ROCKLAND 1 W	7255	44.1	-69.1167
ME	10	SKOWHEGAN	7827	44.7667	-69.7167
MI	1	ALPENA WSO AIRPORT	164	45.0667	-83.5667

State	Sta_#	Sta_Name	COOP_ID	Lat_dd	long_dd
MI	2	BERRIEN SPRINGS 5 W	735	41.9667	-86.4333
MI	3	DETROIT CITY AIRPORT	2102	42.4167	-83.0167
MI	4	FLINT WSCMO	2846	42.9667	-83.75
MI	5	GRAND RAPIDS WSFO	3333	42.8833	-85.5167
MI	6	HANCOCK MCLAIN ST PK	3551	47.2333	-88.6167
MI	7	LANSING WSO AIRPORT	4641	42.7667	-84.6
MI	8	MUSKEGON WSO AIRPORT	5712	43.1667	-86.25
MI	9	SAULT STE MARIE WSO	7366	46.4667	-84.35
MI	10	TRAVERSE CITY	8246	44.7667	-85.5667
MN	1	DULUTH WSO AP	2248	46.8333	-92.2167
MN	2	INT FALLS WSO AP	4026	48.5667	-93.3833
MN	3	MINNEAPOLIS WSFO AP	5435	44.8833	-93.2167
MN	4	ROCHESTER WSO AP	7004	43.9167	-92.5
MN	5	ST CLOUD WSO AP	7294	45.55	-94.0667
MN	6	SHERBURN 3 WSW	7602	43.6333	-94.7667
MN	7	THIEF LAKE REFUGE	8235	48.4833	-95.95
MN	8	TRACY	8323	44.2333	-95.6333
MN	9	WINNIBIGOSHISH DAM	9059	47.4333	-94.0667
MN	10	WINTON POWER PLANT	9101	47.9333	-91.7667
MO	1	COLUMBIA AIRPORT	1791	38.8167	-92.2167
MO	2	KANSAS CITY WSMO AP	4358	39.3167	-94.7167
MO	3	NEVADA WATER PLANT	5987	37.8333	-94.3667
MO	4	PATTONSBURG 2 S	6563	40.0333	-94.1333
MO	5	ROLLA UNI OF MISSOUR	7263	37.95	-91.7833
MO	6	ST LOUIS WSCMO AIRPO	7455	38.75	-90.3667
MO	7	SPRINGFIELD REG AP	7976	37.2333	-93.3833
MO	8	STEFFENVILLE	8051	39.9667	-91.8833
MO	9	WAPPAPELLO DAM	8700	36.9333	-90.2833
MO	10	WEST PLAINS	8880	36.75	-91.8333
MS	1	ARKABUTLA DAM	237	34.75	-90.1333
MS	2	BOONEVILLE	955	34.6667	-88.5667
MS	3	CALHOUN CITY 2 NW	1314	33.8667	-89.35
MS	4	CLEVELAND 3 N	1743	33.8	-90.7167
MS	5	JACKSON WSFO AIRPORT	4472	32.3167	-90.0833
MS	6	LEAKESVILLE	4966	31.15	-88.55
MS	7	LEXINGTON 2 NNW	5062	33.1333	-90.0667
MS	8	MERIDIAN WSO ARPT	5776	32.3333	-88.75
MS	9	RUTH 1 SE	7714	31.3667	-90.3

State	Sta_#	Sta_Name	COOP_ID	Lat_dd	long_dd
MS	10	SAUCIER EXP FOREST	7840	30.6333	-89.05
MT	1	BILLINGS WSO	807	45.8	-108.533
MT	2	CLARK CANYON DAM	1781	45	-112.867
MT	3	CUT BANK FCWOS	2173	48.6	-112.367
MT	4	GLASGOW WSO AIRPORT	3558	48.2167	-106.617
MT	5	GREAT FALLS WSCMO AI	3751	47.4833	-111.367
MT	6	HELENA WSO	4055	46.6	-112
MT	7	HILGER	4143	47.25	-109.35
MT	8	ISMAY	4442	46.5	-104.8
MT	9	KALISPELL WSO AIRPOR	4558	48.3	-114.267
MT	10	MISSOULA WSO AP	5745	46.9333	-114.1
NC	1	ASHEVILLE REGIONL AP	300	35.4333	-82.55
NC	2	CAPE HATTERAS NWS	1458	35.2667	-75.55
NC	3	CHARLOTTE DOUGLAS AP	1690	35.2167	-80.9333
NC	4	ELIZABETH CITY	2719	36.3167	-76.2
NC	5	GRNSBR,HGH PT,W-S AP	3630	36.0833	-79.95
NC	6	HELTON	3957	36.55	-81.5
NC	7	LAURINBURG	4860	34.75	-79.45
NC	8	MOREHEAD CITY 2 WNW	5830	34.7333	-76.7333
NC	9	RALEIGH DURHAM AP	7069	35.8667	-78.7833
NC	10	WILMINGTON NEW HANVR	9457	34.2667	-77.9
ND	1	ASHLEY	382	46.0333	-99.3667
ND	2	BALDHILL DAM	450	47.0333	-98.0833
ND	3	BISMARCK WSFO AP	819	46.7667	-100.75
ND	4	BOWMAN	995	46.1833	-103.4
ND	5	FARGO WSO AP	2859	46.9333	-96.8167
ND	6	MINOT EXPERIMENT STN	5993	48.1833	-101.3
ND	7	RICHARDTON ABBEY	7530	46.8833	-102.317
ND	8	ROLETTE	7655	48.6667	-99.8333
ND	9	TROTTERS 3 SSE	8812	47.2833	-103.9
ND	10	WILLISTON WSO	9425	48.1833	-103.633
NE	1	AMELIA 2 W	180	42.2333	-98.95
NE	2	EDISON	2560	40.2833	-99.7833
NE	3	GRAND ISLAND WSO AP	3395	40.9667	-98.3167
NE	4	HEBRON	3735	40.1667	-97.5833
NE	5	MALMO 3 E	5112	41.2667	-96.65
NE	6	NORFOLK AIRPORT	5995	41.9833	-97.4333
NE	7	NORTH PLATTE WSO ARP	6065	41.1333	-100.7

State	Sta_#	Sta_Name	COOP_ID	Lat_dd	long_dd
NE	8	OSHKOSH 10 NE	6386	41.5	-102.183
NE	9	SCOTTSBLUFF AP	7665	41.8667	-103.6
NE	10	VALENTINE WSO AP	8760	42.8833	-100.55
NH	1	BRISTOL	998	43.6	-71.7167
NH	2	CONCORD MUNI AP	1683	43.2	-71.5
NH	3	DURHAM	2174	43.15	-70.95
NH	4	ERROL	2842	44.7833	-71.1333
NH	5	LINCOLN	4732	44.05	-71.6667
NH	6	MOUNT WASHINGTON	5639	44.2667	-71.3
NH	7	NEW DURHAM 3 NNW	5780	43.4833	-71.1833
NH	8	NORTH STRATFORD	6234	44.75	-71.6333
NH	9	PITTSBURG RESERVOIR	6856	45.05	-71.3833
NH	10	SURRY MOUNTAIN LAKE	8539	43	-72.3167
NJ	1	ATLANTIC CITY INT AP	311	39.45	-74.5667
NJ	2	CAPE MAY 2 NW	1351	38.95	-74.9333
NJ	3	CLINTON 2 N	1754	40.6667	-74.9167
NJ	4	GLASSBORO 2 W	3291	39.7	-75.1167
NJ	5	NEWARK INTL ARPT	6026	40.7	-74.1667
NJ	6	NEW BRUNSWICK 3 SE	6055	40.4667	-74.4333
NJ	7	SPRINGFIELD	8423	40.7167	-74.3167
NJ	8	WANAQUE RAYMOND DAM	9187	41.05	-74.3
NJ	9	WATCHUNG	9271	40.6667	-74.4167
NJ	10	WINDSOR	9761	40.25	-74.5833
NM	1	ALBUQUERQUE WSFO AIR	234	35.05	-106.617
NM	2	ANIMAS	417	31.95	-108.817
NM	3	AUGUSTINE 2 E	640	34.0833	-107.617
NM	4	CARLSBAD	1469	32.4333	-104.25
NM	5	CARRIZOZO 1 SW	1515	33.6333	-105.883
NM	6	CUBA	2241	36.0167	-106.967
NM	7	DURAN	2665	34.4667	-105.4
NM	8	JORNADA EXP RANGE	4426	32.6167	-106.733
NM	9	OCATE 2 NW	6275	36.2	-105.067
NM	10	TUCUMCARI 4 NE	9156	35.2	-103.683
NV	1	BEATTY 8 N	718	37	-116.717
NV	2	CONTACT	1905	41.7667	-114.75
NV	3	ELKO FCWOS	2573	40.8333	-115.8
NV	4	ELY ASOS	2631	39.2833	-114.85
NV	5	LAS VEGAS AP	4436	36.0833	-115.167

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NV	6	LEONARD CREEK RANCH	4527	41.5167	-118.717
NV	7	PAHRANAGAT W L REFUG	5880	37.2667	-115.117
NV	8	RENO AIRPORT	6779	39.5	-119.783
NV	9	SMOKEY VALLEY	7620	38.7833	-117.167
NV	10	WINNEMUCCA AIRPORT	9171	40.9	-117.8
NY	1	ALBANY COUNTY AP	42	42.75	-73.8
NY	2	BINGHAMTON LINK FLD	687	42.2167	-75.9833
NY	3	BUFFALO GR BUFFLO AP	1012	42.9333	-78.7333
NY	4	CANTON 4 SE	1185	44.5667	-75.1167
NY	5	NEW YORK CNTRL PARK	5801	40.7833	-73.9667
NY	6	OLD FORGE	6184	43.7167	-74.9833
NY	7	ROCHESTER INTL AP	7167	43.1333	-77.6667
NY	8	SYRACUSE HANCOCK AP	8383	43.1167	-76.1167
NY	9	WELLSVILLE	9072	42.1167	-77.95
NY	10	WHITEHALL	9389	43.55	-73.4
OH	1	AKRON CANTON WSO AP	58	40.9167	-81.4333
OH	2	CLEVELAND WSFO AP	1657	41.4167	-81.8667
OH	3	COLUMBUS WSO AIRPORT	1786	40	-82.8833
OH	4	DAYTON WSO AIRPORT	2075	39.9	-84.2
OH	5	MANSFIELD WSO AP	4865	40.8167	-82.5167
OH	6	PANDORA	6405	40.95	-83.9667
OH	7	PORTSMOUTH SCIOTOVIL	6781	38.75	-82.8833
OH	8	TOLEDO EXPRESS WSO A	8357	41.6	-83.8
OH	9	TOM JENKINS DAM-BURR	8378	39.55	-82.0667
OH	10	YOUNGSTOWN WSO AP	9406	41.25	-80.6667
OK	1	CARTER TOWER	1544	34.2667	-94.7833
OK	2	FORT SUPPLY DAM	3304	36.55	-99.5833
OK	3	GOODWELL RESEARCH ST	3628	36.6	-101.617
OK	4	GREAT SALT PLAINS DA	3740	36.75	-98.1333
OK	5	LEHIGH	5108	34.4667	-96.2167
OK	6	MAYFIELD	5648	35.3333	-99.8667
OK	7	OKLAHOMA CITY AIRPOR	6661	35.3833	-97.6
OK	8	TULSA INTL AIRPORT	8992	36.2	-95.8833
OK	9	WEBBERS FALLS DAM	9450	35.55	-95.1667
OK	10	WICHITA MTN WL REF	9629	34.7333	-98.7167
OR	1	ALLEGANY	126	43.4333	-124.033
OR	2	ASTORIA WSO AIRPORT	328	46.15	-123.883
OR	3	BEULAH	723	43.9167	-118.167

State	Sta_#	Sta_Name	COOP_ID	Lat_dd	long_dd
OR	4	EUGENE WSO AIRPORT	2709	44.1167	-123.217
OR	5	LA GRANDE	4622	45.3167	-118.067
OR	6	MEDFORD WSO AP	5429	42.3833	-122.883
OR	7	OCHOCO DAM	6238	44.3	-120.733
OR	8	PENDLETON WSO AIRPOR	6546	45.6833	-118.85
OR	9	PORTLAND INTL AIRPOR	6751	45.6	-122.617
OR	10	SALEM WSO AIRPORT	7500	44.9167	-123
PA	1	ALLENTOWN A-B-E INTL	106	40.65	-75.4333
PA	2	ALVIN R BUSH DAM	147	41.3667	-77.9333
PA	3	ERIE INTL ARPT	2682	42.0833	-80.1833
PA	4	JOHNSTOWN 2	4390	40.3167	-78.9167
PA	5	KANE 1 NNE	4432	41.6833	-78.8
PA	6	PHILADELPHIA INTL AP	6889	39.8833	-75.25
PA	7	PITTSBURGH GR P'BURG	6993	40.5	-80.2167
PA	8	PUTNEYVILLE 2 SE DAM	7229	40.9333	-79.2833
PA	9	WILKES-BARRE SCRANTN	9705	41.3333	-75.7333
PA	10	YORK 1 S FILTER PLAN	9938	39.9333	-76.7333
PR	1	COROZAL SUBSTATION	2934	18.3333	-66.3667
PR	2	PONCE 4 E	7292	18.0167	-66.5333
PR	3	SAN JUAN ISLA VERDE	8812	18.4333	-66
PR	4	SAN SEBASTIAN 2 WNW	8881	18.35	-67.0167
PR	5	YABUCOA 1 NNE	9829	18.0667	-65.8667
RI	1	BLOCK IS STATE AP	896	41.1667	-71.5833
RI	2	NEWPORT ROSE	5215	41.5	-71.35
RI	3	PROVIDENCE GREEN ST	6698	41.7333	-71.4333
SC	1	BISHOPVILLE 8 NNW	736	34.3333	-80.3
SC	2	CHARLESTON INTL ARPT	1544	32.9	-80.0333
SC	3	CLARK HILL 1 W	1726	33.6667	-82.1833
SC	4	COLUMBIA METRO AP	1939	33.95	-81.1167
SC	5	GEORGETOWN 2 E	3468	33.35	-79.25
SC	6	GREER GREENV'L-SPART	3747	34.9	-82.2167
SC	7	JOCASSEE 8 WNW	4581	34.9833	-83.0667
SC	8	LAURENS	5017	34.5	-82.0333
SC	9	MULLINS 4 W	6114	34.2	-79.3167
SC	10	SANTEE COOP SPLWY	7712	33.45	-80.15
SD	1	BUFFALO	1114	45.6	-103.55
SD	2	EDGEMONT	2557	43.3	-103.833
SD	3	HURON AP	4127	44.4	-98.2167

State	Sta_#	Sta_Name	COOP_ID	Lat_dd	long_dd
SD	4	ISABEL	4268	45.4	-101.433
SD	5	LA CREEK NATL WILDLI	4651	43.1	-101.567
SD	6	OAHE DAM	6170	44.45	-100.417
SD	7	PICKSTOWN	6574	43.0667	-98.5333
SD	8	RAPID CITY WSO AP	6937	44.05	-103.05
SD	9	SIOUX FALLS WSFO	7667	43.5667	-96.7333
SD	10	WAUBAY NATL WILDLIFE	8980	45.4333	-97.3333
TN	1	BRISTOL WSO AIRPORT	1094	36.4833	-82.4
TN	2	BROWNSVILLE SEWAGE P	1150	35.5833	-89.2667
TN	3	CHATTANOOGA WSO AP	1656	35.0167	-85.2
TN	4	KNOXVILLE WSO AIRPOR	4950	35.8333	-83.9833
TN	5	LEWISBURG EXP STN	5187	35.4167	-86.8
TN	6	MEMPHIS WSCMO AP	5954	35.05	-90
TN	7	MONTEREY	6170	36.15	-85.2667
TN	8	NASHVILLE NWSCMO AP	6402	36.1167	-86.6833
TN	9	PORTLAND SEWAGE PLAN	7359	36.5833	-86.5333
TN	10	SAMBURG WILDLIFE REF	8065	36.45	-89.3167
TX	1	ABILENE WSO AIRPORT	16	32.4167	-99.6833
TX	2	AMARILLO WSO AIRPORT	211	35.2333	-101.7
TX	3	BROWNSVILLE WSO AP	1136	25.9	-97.4333
TX	4	CORPUS CHRISTI WSFO	2015	27.7667	-97.5
TX	5	EL PASO AP	2797	31.8	-106.4
TX	6	HOUSTON WSCMO AP	4300	29.9667	-95.35
TX	7	SAN ANGELO WSO AP	7943	31.3667	-100.483
TX	8	SAN ANTONIO INTL AP	7945	29.5333	-98.4667
TX	9	WACO WSO AP	9419	31.6167	-97.2167
TX	10	WICHITA FALLS WSO AP	9729	33.9833	-98.5
UT	1	BLANDING	738	37.6167	-109.483
UT	2	DUGWAY	2257	40.1833	-112.917
UT	3	EPHRAIM SORENSENS FL	2578	39.3667	-111.583
UT	4	HANKSVILLE	3611	38.3667	-110.717
UT	5	LOGAN UTAH STATE UNI	5186	41.75	-111.8
UT	6	MILFORD	5654	38.4	-113.017
UT	7	OGDEN PIONEER P H	6404	41.25	-111.95
UT	8	ROOSEVELT RADIO	7395	40.2833	-109.967
UT	9	ST GEORGE	7516	37.1167	-113.567
UT	10	SALT LAKE CITY NWSFO	7598	40.7667	-111.95
VA	1	HURLEY	4180	37.4167	-82.0167

State	Sta_#	Sta_Name	COOP_ID	Lat_dd	long_dd
VA	2	JOHN H KERR DAM	4414	36.6	-78.2833
VA	3	LYNCHBURG MUNI AP	5120	37.3333	-79.2
VA	4	NORFOLK INTL ARPT	6139	36.9	-76.2
VA	5	PIEDMONT RESEARCH ST	6712	38.2167	-78.1167
VA	6	RICHMOND BYRD AP	7201	37.5167	-77.3333
VA	7	ROANOKE WOODRUM AP	7285	37.3167	-79.9667
VA	8	THE PLAINS 2 NNE	8396	38.9	-77.75
VA	9	WASHINGTN DC NATL AP	8906	38.85	-77.0333
VA	10	WYTHEVILLE 1 S	9301	36.9333	-81.0833
VI	1	BETH UPPER NEW WORKS	480	17.7167	-64.8
VI	2	CANEEL BAY PLANTATIO	1316	18.35	-64.7833
VT	1	BALL MOUNTAIN LAKE	277	43.1167	-72.8
VT	2	BURLINGTON INTL AP	1081	44.4667	-73.15
VT	3	CORINTH	1565	44.0167	-72.2833
VT	4	HIGHGATE FALLS	3914	44.9333	-73.05
VT	5	MORRISVILLE	5366	44.5667	-72.6
VT	6	NEWPORT	5542	44.9333	-72.2
VT	7	NORTH HARTLAND LAKE	5768	43.6	-72.35
VT	8	NORTH SPRINGFIELD LA	5982	43.3333	-72.5
VT	9	SAINT JOHNSBURY	7054	44.4167	-72.0167
VT	10	SEARSBURG STATION	7152	42.8667	-72.9167
WA	1	COUGAR 4 SW	1759	46.0167	-122.35
WA	2	FRANCES	2984	46.55	-123.5
WA	3	MARBLEMOUNT RANGER S	4999	48.5333	-121.45
WA	4	OLYMPIA AIRPORT	6114	46.9667	-122.9
WA	5	QUILLAYUTE WSCMO AP	6858	47.95	-124.55
WA	6	SEATTLE TACOMA AIRPO	7473	47.45	-122.3
WA	7	SNOQUALMIE PASS	7781	47.4167	-121.417
WA	8	SPOKANE WSO AIRPORT	7938	47.6333	-117.533
WA	9	WHITMAN MISSION	9200	46.05	-118.45
WA	10	YAKIMA WSO AP	9465	46.5667	-120.533
WI	1	ASHLAND EXP FARM	349	46.5667	-90.9667
WI	2	CHIPPEWA FALLS	1578	44.9333	-91.3833
WI	3	GREEN BAY WSO	3269	44.5	-88.1167
WI	4	LA FARGE	4404	43.5667	-90.6333
WI	5	LANCASTER 4 WSW	4546	42.8333	-90.7833
WI	6	MADISON WSO AIRPORT	4961	43.1333	-89.3333
WI	7	MARSHFIELD EXP FARM	5120	44.6333	-90.1333

State	Sta_#	Sta_Name	COOP_ID	Lat_dd	long_dd
WI	8	MILWAUKEE WSO AIRPOR	5479	42.95	-87.9
WI	9	PHELPS	6518	46.0667	-89.0667
WI	10	SPOONER EXPERMNT FAR	8027	45.8167	-91.8833
WV	1	BECKLEY WSO AP	582	37.7833	-81.1167
WV	2	CHARLESTON AP	1570	38.3667	-81.6
WV	3	ELKINS WSO AIRPORT	2718	38.8833	-79.85
WV	4	HUNTINGTON WSO AP	4393	38.3667	-82.55
WV	5	LAKE LYNN	5002	39.7167	-79.85
WV	6	LIVERPOOL	5323	38.9	-81.5333
WV	7	MOOREFIELD 2 SSE	6163	39.0333	-78.9667
WV	8	TERRA ALTA NO 1	8777	39.45	-79.55
WV	9	TYGART DAM	8986	39.3167	-80.0333
WV	10	VALLEY HEAD	9086	38.5333	-80.0333
WY	1	CASPER WSCMO	1570	42.9	-106.467
WY	2	CHEYENNE WSFO AP	1675	41.15	-104.817
WY	3	MORAN 5 WNW	6440	43.85	-110.583
WY	4	ENCAMPMENT	3050	41.2167	-106.783
WY	5	JACKSON	4910	43.4833	-110.767
WY	6	LAKE YELLOWSTONE	5345	44.55	-110.4
WY	7	LANDER AP	5390	42.8167	-108.733
WY	8	MOUNTAIN VIEW	6555	41.2833	-110.317
WY	9	OSAGE	6935	43.9833	-104.417
WY	10	SHERIDAN AP	8155	44.7667	-106.967